Country Water Submission to

IPART's Review of Prices for Water and Sewerage Services to Broken Hill and Surrounds

September 2009

countrywater

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1 INTRODUCTION

1.1 Basis for Submission

This submission has been prepared by Country Water, a part of Country Energy's Infrastructure Operations division, in accordance with the requirements of the Independent Pricing and Regulatory Tribunal's (IPART's) Water Issues Paper published in July 2009 (the Issues Paper).

1.2 Content of this Submission

The purpose of this document is to set out such information as is necessary to enable IPART to understand the background to and basis and derivation of the proposed service levels and prices applying to Country Water's customers in the next regulatory period.

In accordance with the Issues Paper, this submission details the information requested. However, some sensitive information has been aggregated or generalised to ensure that it is not unduly harmful to Country Waters' legitimate business interests.

This document is structured as follows:

- Section 2 provides background to Country Water and the operation of the water and sewerage network
- Section 3 outlines the services to be offered to customers
- Section 4 summarises Country Water's forecast demand for services for the regulatory period
- Section 5 provides information on capital expenditure
- Section 6 outlines the calculation of regulatory depreciation
- Section 7 presents the regulatory asset base for the regulatory period
- Section 8 details the weighted average cost of capital applied to the regulatory asset base
- Section 9 provides information regarding operating expenditure
- Section 10 explains how the total revenue requirement has been calculated and describes the structure of tariffs, and the form of price control
- Section 11 outlines other matters relating to the regulatory period not addressed elsewhere
- Section 12 lists a glossary of terms, and
- Section 13 presents a list of appendices attached to this submission

1.3 Interpretation

In this submission, headings are for convenience only and do not affect interpretation unless the context indicates a contrary intention:

- A reference to any party includes that party's executors, administrators, successors, substitutes and assigns, including any person taking by way of novation
- Words importing the singular include the plural (and vice versa), words denoting a given gender include all other genders, and words denoting individuals include corporations (and vice versa)
- References to currency are references to Australian currency unless otherwise specifically provided
- Data presented in tables contained in this submission may not add due to rounding
- Reference to any legislation or to any section or provision thereof includes any statutory modification or re-enactment or any statutory provision substituted for it, and ordinances, by-laws, regulations, and other statutory instruments issued thereunder, and
- References to capital expenditure are references to net capital expenditure, exclusive of capital contributions, unless otherwise stated.

1.4 Contact Details

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2 BACKGROUND TO THE WATER AND SEWERAGE NETWORK

Country Water is responsible for the delivery of water and sewerage services in Broken Hill and water supply only to Menindee, Silverton and Sunset Strip in far west New South Wales.

2.1 Country Water's Far West Network

In 1883 a rich mineral deposit (silver, lead and zinc) was discovered on what now is known as the city of Broken Hill. Approximately 280,000 million tonnes of ore have been extracted from the "Line of Lode" and this wealth has contributed substantially to the industrial development of Australia.

During the first sixty nine years of its life, Broken Hill was plagued by water shortages. Permanent natural waterholes were almost non existent, local water courses only ran for short periods after rain, and shallow depressions holding precious water dried up quickly through soakage and evaporation. The first attempt to provide an organised supply for the fledgling mining town was the reservation of the Stephens Creek soakage, some 16 kilometres north-east of the town. A limited quantity of water was obtained by sinking shallow wells, and then the water was carted by bullock drays in square iron holding tanks to Broken Hill. This source was again unreliable.

Two small dams, White Leeds Dam and The Imperial Dam, were constructed in about the middle of 1888, and together with the Stephens Creek soakage formed the main supply of water. Construction of the Stephens Creek Reservoir was completed in 1891 and provided water to the city in 1892, and remains in place today. However, this storage did not meet the water demands of the community and mining industry. A further reservoir at Umberumberka was completed in 1914, and water was first pumped to Broken Hill, some 28 kilometres away. It was not until the completion of the Darling River to Broken Hill pipeline in 1952 that Broken Hill was provided with a more reliable water source.

The then NSW Water Conservation and Irrigation Commission constructed a series of weirs, regulators and banks on the lakes in the 1950s and 1960s to form the Menindee Lakes water storage scheme. A dam on the Darling River at the inflow to Lake Pamamaroo forms the artificial Lake Wetherell under high water conditions. The purpose of the scheme was to store and conserve water for domestic, stock and irrigation water supply, including water storage for South Australia.

In 1958 Weir 32 on the Darling River at Menindee was completed, and the entire Menindee Lakes storage project was opened in November 1960.

Water supply to Broken Hill, Menindee and Sunset Strip is treated before distribution. Water supply to Silverton is chlorinated, but presently unfiltered. Non-potable water is also supplied to rural users along the Menindee to Broken Hill pipeline for stock and domestic purposes.

Country Water utilises four water sources, as described below.

Darling River

The Darling River off-take at the Menindee Lakes Scheme is the main source of water for Country Water. The river is partly regulated through release of water from Lake Wetherell, part of the Menindee Lakes Scheme. Country Water uses an intake structure in the river at Menindee and a pump station to pump water to Broken Hill. The licensed entitlement is 9.975 gigalitres (GL) per year of high security water. Country Water also has a licence for 29 ML per year for raw water for Menindee.

The water has to be pumped a height of 287 metres over a distance of 116 kilometres from its source at the Darling River to the Mica Street water treatment plant.

During drought (when the total storage in the scheme falls below 480 GL and until it returns to 640 GL), the management of the Menindee Lakes Scheme, in terms of making available Country Water's licence entitlement rests with the NSW Department of Water and Energy through State Water. At all other times, the management of the lakes scheme rests with the Murray Darling Basin Commission.

Stephens Creek

Stephens Creek Reservoir is a 19,000 ML reservoir with a large surface area and a shallow depth, meaning evaporative losses from the storage have historically been high and the reservoir's efficiency low. A levy was placed in the reservoir in 2003, which has significantly reduced the evaporative losses when inflow occurs. Stephens Creek reservoir receives water from its own catchment, as well as water pumped from the Darling River. The quality of water in this reservoir tends to be controlled by the quality of the water transferred to it from the Darling River.

Umberumberka

Umberumberka is a 7,800 ML reservoir located 28 kilometres north-west of Broken Hill on Umberumberka Creek. Water is pumped to Blue Anchor tank using diesel pumps, and then gravity fed to Broken Hill, supplying Silverton as it passes by. The quality of water from this source is generally very good and tends to be the best of all the available sources. Umberumberka Dam is a deep, efficient storage, but its catchment is unreliable as a sustainable water source – filling only once every 15 years.

Imperial Lake

Imperial Lake is a small, 670 ML reservoir that collects water from its own small catchment which includes part of the Broken Hill urban area. Water can be transferred to Imperial Lake from Stephens Creek and Umberumberka via the Mica Street water treatment plant. The lake is used as an emergency storage only. The quality of water from this source is highly variable not only because of its urban catchment, but also the fact that as it is only used in emergency situations, the salt, organic and metals concentrations of the stored water can be high.

Figure 1 below provides a schematic diagram of the water supply network supplying Broken Hill and surrounding regions.

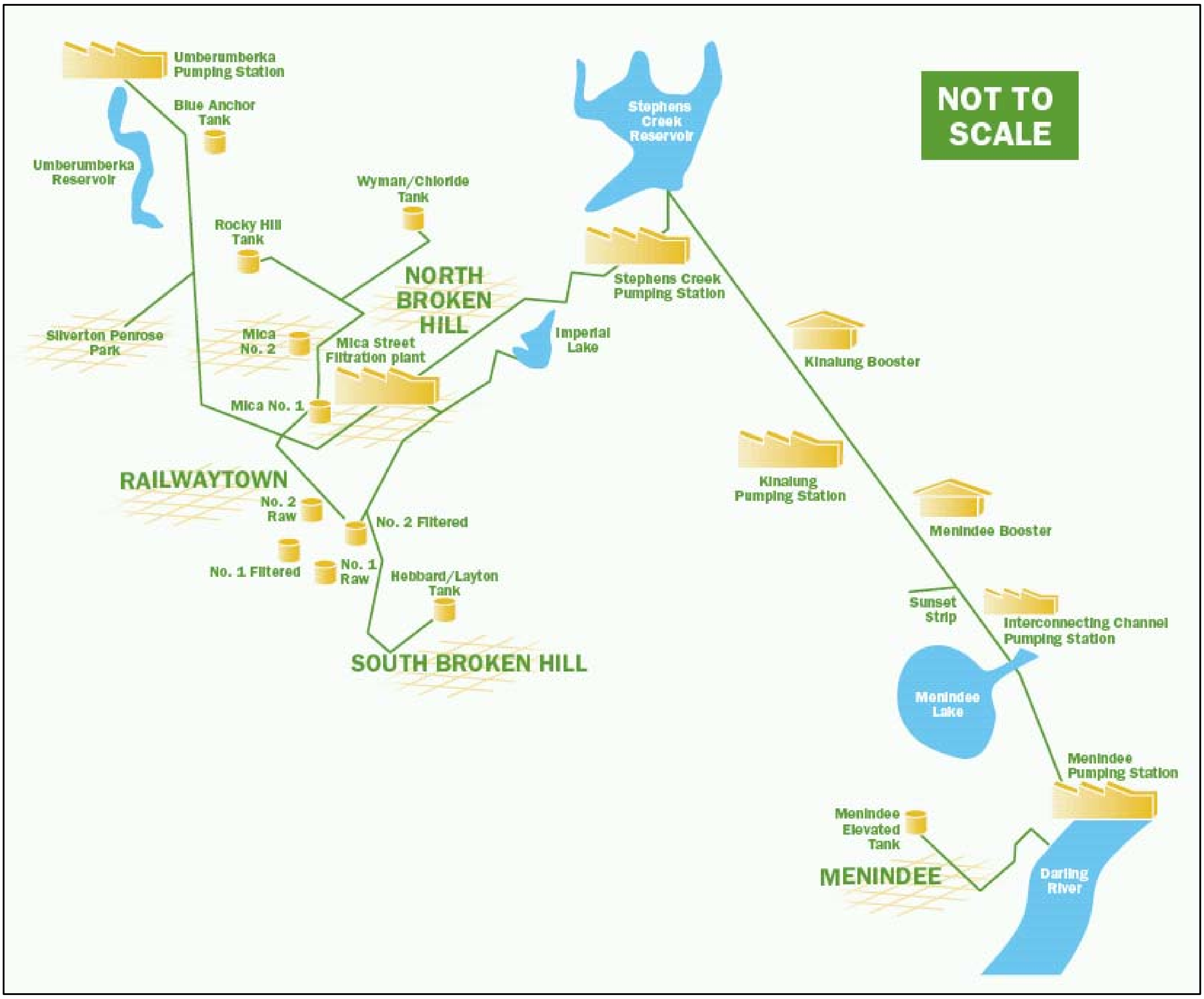

Figure 1 Water Supply Network Diagram for Broken Hill Supply Area

There are two waste water treatment plants in Broken Hill. The Wills Street waste water treatment plant was constructed in 1940 and augmented in 1957. By 1961, 91 per cent of Broken Hill had sewerage available and 71 per cent of premises were connected. The main part of the city was connected by 1962. The Wills Street waste water treatment plant was further upgraded in the 1980s.

The South Broken Hill treatment plant was operational by the end of 1962, making sewerage available to 29 per cent of houses in that area. The work was completed in 1964. Minimal upgrades and renewal have been carried out since the system was commissioned.

2.2 Water Consumption

Water sales have progressively decreased over time through community awareness and reductions in consumption, declining customer levels and the introduction of a number of water savings programs to achieve targeted conservation of water.

Water savings programs have included:

- Developing educational resources and training for grounds people, providing the skills and knowledge to be more efficient and effective irrigators
- Developing public demonstration sites to illustrate affordable and environmentally water wise ways to manage arid urban landscapes
- H2Overhaul retrofit program designed to address residential water and energy efficiency
- Sponsorship of a water wise gardening course at the local community college
- Water Wise & Lead Safe Program to encourage efficient outdoors water use
- Providing water efficiency advice and a water efficiency calculator available at www.countrywater.com.au
- Rolling out an innovative small business program 'Outback Oasis' that provided education to businesses on a range of efficiency programs for water, energy, waste and other business operations
- Implementation of a two step water demand management tariff, and
- Water use study completed to further develop efficiency programs.

2.3 Physical Characteristics of the Network

2.3.1 System Description

Country Water is part of Country Energy's Infrastructure Operations division and provides water supply services to a population of over 20,000 in Broken Hill, Menindee, Sunset Strip and Silverton. In also provides sewerage services to Broken Hill. Country Water provides water services to approximately 10,500 properties and sewerage services to approximately 9,500 properties.

Country Water's objective is to:

- Provide water and sewerage services that meet customers' needs for reliability, and environmental performance;
- Maintain a water and sewerage system that is safe for the community, customers and employees; and
- Minimise the costs to Country Water and consequent impacts on pricing for its customers.

The service area is the most arid in the state and experiences extreme climatic variations including frequent droughts. Eight years in every ten, town water supply is dependent on water sourced from the Darling River and pumped over 116 kilometres of pipeline to Broken Hill. These unique operational circumstances combined with drought conditions cause salinity and other water quality problems in the raw water that Country Water must treat.

Country Water is an end water user and is licensed to extract 10 GL of water per year from the Menindee Lakes Scheme on the Darling River. There are three other sources of water. These are managed by Country Water:

- Stephen's Creek - capacity 19,000ML
- Umberumberka - capacity 7,800ML
- Imperial Lake (emergency water supply) - capacity 670ML

These act as stores for water from rainfall over the local catchment area. Stephens Creek also acts as a terminal storage for water from the Menindee Lakes Scheme before it is pumped to the Mica Street water treatment plant. The reservoirs supply between 30-90 per cent of annual water needs. However, this is highly variable, dependent on the level of rainfall received over the local catchment area, and can be critical in times of drought.

A schematic diagram of the Country Water supply network is set out in Figure 1 above.

2.3.2 Network Operation

Country Water's supply network includes the following major assets:

- Steel/concrete 600mm pipeline from Menindee to Broken Hill (~120 kilometres)
- 11 water service tanks
- 2 reservoirs (Stephen's Creek and Umberumberka)
- 1 emergency dam supply (Imperial Lake)
- 7 water pumping stations
- Water filtration plants (two potable, and one not yet declared potable)
- 558 km of water and sewer mains
- 2 sewerage treatment plants
- 11 sewerage pumping stations

Water Reticulation

Water reticulation in Broken Hill extends from the Mica Street water treatment plant through to the customer's meter. Water is pumped from the treatment plant through a number of rising mains to tanks located on elevated positions throughout the Broken Hill and Broken Hill South district. Once the water is stored in these tanks, delivery is by gravity feed, so it is possible to maintain supply for a limited period without electricity.

There has been a sustained programme over a number of years to replace the larger distribution mains, particularly the larger asbestos cement pipes gravitating from the tanks. Since the distribution network is generally in excess of 50 years old, most of the distribution pipes are asbestos cement (A/C), with galvanised services to customers. Where the A/C pipes have burst, or the galvanised pipes have corroded, they have been replaced with PVC pressure pipe. Customer service lines have been replaced with copper.

The entire distribution network is divided into separate pressure zones, which results in lower customer outages, faster repairs, and lower losses in the event of a burst pipe.

Water Treatment

The Broken Hill Mica Street water treatment plant was constructed in 1952 with a maximum capacity of 36ML per day. The water treatment plant uses a conventional water treatment process.

Aluminium Sulphate (Alum) is added to the raw water and it then goes through the processes of coagulation and flocculation. Lime is added for pH correction, pre chlorinate is added and powder activated carbon if needed. A non ionic polymer (polyelectrolyte) is added to enhance the flocculation process. The water is transferred to the sedimentation tank for settling suspended solids, and then transferred to the sand filters for removal of remaining suspended solids. The reverse osmosis plant can be brought online to provide a side stream of desalinated water prior to final disinfection. Fluoride is added to meet health standards. Final disinfection using chlorine ensures residual chlorine levels at the extremities of the reticulation system comply with Australian Drinking Water Guidelines.

The treated water is stored at Mica Street water treatment plant and then pumped to service reservoirs located at Block 10 (services Central and South Broken Hill) and Wyman and Rocky Hill (services North and West Broken Hill).

The Menindee water treatment plant uses a similar process, with the exception of the use of polyelectrolyte as a flocculation enhancer.

Sunset Strip is currently a non potable water supply. Raw water is taken off the Menindee to Kinalung pipeline. A micro filtration process takes place with a filter of 0.2 microns. The raw water then passes through a carbon filter, and is chlorinated and distributed to the residents of Sunset Strip. With the installation of an emergency clear water pump, the water supply should be declared potable in 2009/2010.

The Silverton water supply is also non potable. Raw water is taken off the Umberumberka to Broken Hill pipeline, chlorinated and then distributed to the residents of Silverton.

Sewerage Reticulation

Sewerage reticulation is divided into two zones, north and south of the Broken Hill “Line of Lode”. Due to the topography of the city, the northern network feeds, via a number of pumping stations, to a major pumping station at Warren Street, the low point in the city. The sewerage needs to be pumped away from Warren Street, across town to Wills Street where the treatment plant is located. The treatment plant could not be located at Warren Street, because of the risk of effluent draining into the Imperial Lake reservoir.

One of the operational risks faced with a sewer rising main is the sewerage turning septic from lack of oxygen, and the rising main from Warren Street to Wills Street has resulted in septic material in the line and also arriving at the treatment plant.

The network of pipes is very old, mostly of clay, and in poor condition. Frequently the pipes need to be scoured because they are blocked with roots and debris. When the network was first constructed, due to the topography, and rocky nature of the ground, most of the pipes take the shortest route through properties. The condition of the network in the southern part of the city is similar.

Sewerage Treatment

There are two waste water treatment plants in Broken Hill. Waste water is reticulated from individual properties through approximately 20 kilometres of rising mains and 175 kilometres of gravitation mains to 11 sewerage pumping stations in Broken Hill, and then to either the Wills Street or South Broken Hill waste water treatment plant. Both plants utilise conventional anaerobic trickling filters. Wills Street treats 3 ML of influent per day, and South Broken Hill treats 0.8 ML of influent per day.

Treated effluent water use accounts for approximately 50 per cent of effluent water, with the remaining 50 per cent discharged to the environment through evaporation ponds.

3 SERVICES TO BE OFFERED

Country Water proposes to offer services consistent with the current structure and level of services offered to customers. Country Water also proposes to offer a number of miscellaneous services in the regulatory period, consistent with current practice.

3.1 Water Services

Country Water has four types of water services available, although all services are not available in all areas. The water services and their availability are as follows:

- Treated water – available in Broken Hill and Menindee
- Untreated water– available in selected locations of Broken Hill and Menindee, and pipeline customers
- Chlorinated water – available in Silverton and Sunset Strip
- Effluent water– available in selected locations of Broken Hill

3.1.1 Treated Water

Treated water is commonly known as potable water or drinking water. The water is treated with a disinfection process and filtered to a standard that is primarily intended for human consumption. The disinfection process is designed to kill most microorganisms in water, including essentially, all pathogenic (disease-causing) bacteria. There are several ways to disinfect, with chlorine being the most frequently used in water treatment.

3.1.2 Untreated Water

Untreated water is also referred to as raw water. This is water in its natural state, prior to any treatment process, or the water entering the first treatment process of a water treatment plant. It is not suitable for human consumption.

3.1.3 Chlorinated Water

Chlorinated water is raw water that has been treated with a chlorine disinfection process, but not filtered to remove solids and organic particles. This water is not suitable for human consumption.

3.1.4 Effluent Water

Effluent water is sewage or waste water that is treated at a sewerage treatment plant before being re-used or discharged to the environment. Effluent water is not suitable for human consumption and may only be re-used under specific environmental conditions.

3.2 Sewerage Services

Country Water provides sewerage services to the city of Broken Hill only. A small number of properties in Broken Hill do not have access to sewerage services.

3.3 Liquid Trade Waste Services

Country Water provides liquid trade waste services to non residential customers in the city of Broken Hill only. Charges are levied based on the category of trade waste customer, dependent on the type and level of discharge of identified trade waste into the sewerage system.

Determination of categories of liquid trade waste customers is on the basis of classification criteria set by the NSW Liquid Trade Waste Guidelines. Liquid trade waste services and accompanying charges may include the following:

- Application fee – recovers the cost of services provided in processing applications for approval to discharge liquid trade waste. The application fee is levied based on the category of trade waste customer, and is applied on application, renewal or change of ownership.
- Annual trade waste fee – recovers the costs of administration and scheduled inspections each year to ensure trade waste customers' ongoing compliance with the conditions of their discharge approval. More complex individual customers may require monitoring of their discharge, and these fees are based on full cost recovery. The annual trade waste fee is levied based on the category of trade waste customer.
- Re-inspection fee – where non-compliance with the conditions of an approval has been detected and the discharger is required to address the issues identified, a re-inspection of the customer premises may be required to confirm compliance. The re-inspection fee is charged for each customer site visit.
- Trade waste usage charge – is charged based on the proportional amount of discharge to the sewerage system that is identified as liquid trade waste. Where certain categories of customers have not installed and maintained appropriate pre-treatment facilities, a non-compliant trade waste usage charge can be levied.
- Excess mass charge – will apply for substances discharged in excess of the deemed concentrations in domestic sewerage. This is a usage charge and is particular to individual customers based upon the results of monitoring of their trade waste discharge.
- Food waste disposal charge – applies to existing installations of food waste disposal units where their installation is approved. New installations are not permitted.
- Non-compliance excess mass charge – will apply where a discharge fails to comply with the approved concentration limits of substances specified in the customers approval conditions. This is a usage charge and is particular to individual customers based upon the results of monitoring of their trade waste discharge.
- Non-compliance penalty – covers instances where compensation to recover the cost of legal action, damage to infrastructure, incurred fees or other matters resulting from illegal, prohibited or unapproved liquid trade waste discharged into the sewerage system.

3.4 Miscellaneous Services

A range of miscellaneous services are offered to customers, generally for one off services including, but not limited to, connections and disconnections, replacing damaged services, plumbing inspections, site inspections and building plan approvals. These charges are levied to a relatively small number of customers, and are charged on an as incurred basis.

3.5 Service Standards and Quality

Country Water will provide services in accordance with the following service standards.

Water safety and quality

A stringent regime of testing and quality assurance ensures Country Water meets Australian Drinking Water Guidelines set by the National Health and Medical Research Council and the Agriculture and Resource Management Council of Australia and New Zealand. The testing process includes taking water samples from 38 locations including reservoirs, at the inlet and outlet of water filtration plants and from various other locations throughout the water network.

Testing is conducted by the Australian Water Quality Centre and the Department of Analytical Laboratories (independent laboratories certified to the National Association Testing Authority Standards) and the results are reviewed by NSW Health. This strict water quality testing ensures Australian Drinking Water Guidelines are met.

Each year, Country Water publishes a summary of test results for samples collected over the past 12 months, outlining health and key aesthetic characteristics that have been selected in consultation with NSW Health. The results are also issued annually in a brochure sent to customers with their water accounts.

Water quality test results for 1 January to 31 December 2008 indicated that drinking water quality had complied with health related guideline values, as well as the aesthetic values, in the Australian Drinking Water Guidelines. Country Water is also undertaking enhanced public reporting of test results, to be published on the Country Water website on a regular basis.

Service standards and performance monitoring

Country Water strives to meet industry standards for a water utility business. State and National performance monitoring provides benchmarking against other urban water utilities, both metropolitan and regional centres. Whilst Country Water operates in conditions that are unique, such as being 120 kilometres from the primary water source, industry benchmarking does provide opportunities for performance comparison. Detailed levels of service are being reviewed as part of strategic business planning.

Whilst Country Water is not licensed by IPART as a government utility, the intention is to use the IPART license framework as a mechanism to maintain and improve the quality of service offered to customers.

Best Practice Management of Water Supply and Sewerage Services

Country Water complies with the six criteria set by the NSW Government for the best practice management of water supply and sewerage services. Best practice management helps to ensure the effective and efficient delivery of services and promote sustainable water practices and demand management.

The six criteria for best practice management are:

- Strategic Business Planning
- Pricing
- Water Conservation
- Drought Management
- Performance Reporting
- Integrated Water Cycle Management

Country Water is in the process of reviewing some of the key criteria for best practice management. Over the regulatory period, key business documents including strategic business plans, internal and external performance reporting, demand management and drought management, will be updated.

4 FORECAST DEMAND FOR SERVICES

The forecasts of operating expenditure, capital expenditure and projected revenues set out in this submission include adjustments for demand forecasts prepared for Country Water by the National Institute of Economic and Industry Research (NIEIR).

Country Water has adopted a formal methodology to forecast water consumption, demand and new customer growth, supported by external expertise. NIEIR was engaged in early 2008 to research and provide advice on forecasts of key economic parameters that may influence the demand for water services, and to prepare growth forecasts for the Country Water region over the regulatory period.

A number of adjustments have been made since the initial June 2008 NIEIR report review to incorporate changes in demand resulting from the current softening economic conditions including:

- downgrading Country Water’s commercial consumption to reflect the emerging trend of reduced water usage as businesses move to reduce operating costs, and
- downgrading the forecast consumption that is attributed to major customers as a result of decisions to lay off staff as a result of the current economic downturn.

4.1 Overview of Water Demand for Country Water

Country Water serves approximately 10,500 water customers who collectively purchase approximately 5,200ML of water each year, transported through approximately 400 kilometres of pipes and mains. The vast majority of water consumers are residential customers, each using approximately 320kL of water per year. The residential volume market represents approximately 92 per cent of connections whilst only consuming 56 per cent of the total.

Issues emerge when comparisons are made to other water utilities. The difficulty arises in finding a utility operating within a similar environment and under a similar jurisdiction. For example, most other populated remote local water utilities are located on rivers or adjacent to a water source.

When comparing Broken Hill’s water consumption on a per capita basis with similar utilities, some interesting issues emerge including that Broken Hill:

- has its main water source over 120 kilometres away;
- has an arid climate with a low average annual rainfall of 225 millimeters;
- has a customer dependency on evaporative air cooling systems; and
- has a strong message from environmental lead specialists promoting water use to assist in reducing lead levels.

4.2 Forecasts

Details of the key drivers behind the demand forecasts and the methodology used to support the demand forecasts have been developed by NIEIR. A detailed report has been included on a confidential basis as Appendix A.

The customer number forecast for the Network is summarised below in Table 1. The consumption forecast for the network is summarised below in Table 2. Table 3 contains the forecast average consumption for residential and commercial customers for the proposed regulatory period.

Customers (number)	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Residential	9,050	9,022	9,016	9,001	8,989	8,975
Commercial	757	764	763	762	761	760
Total	9,806	9,786	9,779	9,763	9,750	9,735

Table 1 – Total forecast customer numbers for 2007/2008 to 2012/2013

Volume (KL)	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Residential	2,895,920	2,769,831	2,781,731	2,790,887	2,801,196	2,810,979
Commercial	2,236,416	1,813,803	1,817,773	1,819,542	1,821,650	1,823,604
Total	**5,132,336**	**4,583,634**	**4,599,504**	**4,610,429**	**4,622,845**	**4,634,583**

Table 2 – Total forecast volume (KL) for 2007/2008 to 2012/2013

Average Consumption (KL)	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Residential	320	307	309	310	312	313
Commercial	1,236	1,063	1,068	1,073	1,079	1,084

Table 3 – Average consumption (KL) for 2007/2008 to 2012/2013

5 CAPITAL EXPENDITURE

5.1 Asset Management Framework

Asset management covers the processes for planning, development, operation, inspection, condition assessment and maintenance of all components of the water and sewerage assets. The establishment of a sound asset management system and processes are a prerequisite for prudent and efficient capital and operating expenditure programs.

Country Water is the owner and operator of a water distribution and sewerage collection and disposal network. It has a significant investment in the physical water and sewerage system and non-system assets. The business requires that these assets and other resources are efficiently and effectively managed to maximise value to all stakeholders. This requires assets to be developed, operated and maintained in a manner which will permit water and sewerage service delivery targets to be achieved, ensure risks are minimised and asset economic life maximised, in a cost effective manner.

Country Water has prepared a Water Asset Management Plan (WAMP) as a means of strategically managing physical system assets to best support the delivery of water and sewerage services to all connected customers over the planning horizon to 2014-15. The WAMP describes the asset management policies, strategies, plans and practices of Country Water. The objective of the WAMP is to maximise the technical and financial performance of the business for all stakeholders and to consistently provide customers with high quality, safe and reliable water and sewerage services, at the lowest possible price, while preserving the value of public assets.

The general asset management approach adopted by Country Water, as outlined in the WAMP, is reflected in the compilation of the capital expenditure program. The WAMP is an important component of Country Water's corporate strategic direction and the water and sewerage services delivery strategy. This involves the asset management strategies, policies, processes, resources and the planned investments in capacity, security and reliability driven asset augmentation, asset replacement, asset refurbishment and asset maintenance.

5.2 Historical Capital Expenditure

Table 4 below sets out Country Water's actual and estimated capital expenditure for the four years preceding the regulatory period.

$,000 (nominal)	2006-07	2007-08	2008-09	2009-10 estimate	Total
Actual/Estimated Expenditure	4,003	9,831	19,686	30,018	63,539

Table 4 – Actual/estimated total capital expenditure for the last four years

The major component of the asset replacement and refurbishment capital expenditure relates to the long term security of the water system. Some of the localities within Country Water that have had asset replacement of refurbishment related expenditure over the past four years are described below.

5.2.1 Reservoirs

An upgrade of Stephens Creek Reservoir was undertaken during 2006/2007 to improve water collection efficiency and transfer of water to an inner pond ready to pump to Broken Hill.

This reservoir is supported by a dam built in the late 1800's. This is a prescribed dam under the Dams Safety Act 1978, and is therefore subject to regulation by the NSW Dam Safety Committee (DSC). The DSC has determined that the by-wash for this dam does not meet current regulations, and provision has been allowed in the 2009/10 budget for engineering studies on the best way to increase the by-wash capacity to meet regulations.

5.2.2 Pumping stations

Fuel tanks and bunding servicing Umberumberka pumping station were upgraded to comply with environmental and fuel storage standards during 2008/09. The diesel pumping station located at Umberumberka is subject to periodic rebuild or replacement. This pumping station requires a new suction line from the dam wall to the pump intake manifold, and provision has been made for this in 2009/10.

5.2.3 Pipelines

A critical component of Country Water's infrastructure is the pipeline between Menindee and Stephens Creek. The pipeline was constructed between 1946 and 1952, consisting of 100 kilometres of 600mm diameter mild steel cement lined (MSCL) pipe. There are approximately eighteen 3.3 kilometre pipe sections between Menindee and Kinalung, with only one below ground through the Horse Lake section. There are thirteen 3.3 kilometre sections between Kinalung and Stephens Creek pumping stations. Sections of the Menindee to Stephens Creek pipeline require replacement during 2009/10. These works involve replacement of sections of under road crossing pipeline due to corrosion.

Figure 2 Menindee/Broken Hill pipeline burst **Menindee/Broken Hill pipeline**

Sections of the Stephens Creek to Broken Hill pipeline (Rocla main) have been replaced during the past four years. The 450mm pipeline was replaced in the 1950's and 1960's with MSCL and cement reinforced pipe. The steel sections provide little trouble. The cement reinforced (Rocla) Section 4 began failing in the 1980's. Section 4 continued to deteriorate due to the aggressive soil corroding, the reinforcing within the cement pipe resulting in failure of the bells.

With Section 4 failing, cutting supply from Stephens Creek for greater than 36 hours per event, a 2.2 kilometre length was programmed for urgent replacement between 2005/2006 and 2007/2008 due to the high risk associated with water supply to Broken Hill. These works involved replacement of faulty old and corroding steel reinforced concrete pipes with new ductile iron coated pipes.

The 30 kilometre Umberumberka pipeline was commissioned in 1914. This pipeline has a lifetime of 80 to 100 years and therefore is close to the end of its useful life. Sections of the Umberumberka pipeline have been replaced, with corroding old steel pipes being replaced with coated pipes over the past four years.

Figure 3 Umberumberka to Broken Hill pipeline

The brine line will discharge salty water from the reverse osmosis plants at Mica St to evaporation pans. This line is due to be built during 2009/10.

5.2.4 Water treatment plants

The most significant capital expenditure item during the past four years relates to the replacement of the Mica Street water treatment plant, which was originally constructed in 1952. During the 1990's it was recognised that with reduced flows down the Darling River, and poor water quality, greater demands were being placed on the 1950's technology of the water treatment plant.

The water treatment plant replacement program is required to decommission the existing plant which is 50 years old, obsolete and manually operated. The replacement plant consists of a new modern design and is significantly more reliable, more efficient and fully automated in operation. A detailed design project and tender process was conducted in 2006/07 and construction began soon after with the majority of capital expenditure occurring in 2008/2009 and 2009/2010.

5.2.5 Water reticulation

Water reticulation capital expenditure was incurred on regular and ongoing mains renewal to replace obsolete and leaking asbestos cement pipes with modern PVC pipes.

5.2.6 Sewerage pumping stations

Expenditure was incurred at the Warren Street pumping station to replace old pumps and wells with new submersible pumps, new wells and new switchgear.

5.2.7 Sewerage Reticulation

Regular and ongoing expenditure to renew sewer mains vents, access chambers and lids.

5.3 Forecast System Capital Expenditure for the Regulatory Period

Capital expenditure is assessed to ensure that it complies with industry and safety standards.

Table 5 sets out Country Water's forecast capital expenditure for the regulatory period.

$,000 (real 2009-10)	2010-11	2011-12	2012-13	Total
Forecast Capital Expenditure	5,611	12,350	12,308	30,269

Table 5 – Forecast capital expenditure for the regulatory period

The major component of the asset replacement and refurbishment capital expenditure relates to the long term security of the water system. Some of the localities and assets within Country Water that are programmed to have asset replacement or refurbishment related expenditure over the regulatory period are detailed below.

5.3.1 Reservoirs

Umberumberka Reservoir

This reservoir is supported by a concrete dam built in the early 1900's. Because of the age and construction of the dam, it is subject to regular monitoring and works to ensure safety. This is a prescribed dam under the Dams Safety Act 1978, and is therefore subject to regulation by the NSW DSC. Provision has been made in 2012/2013 for refurbishment works to ensure continued safety and compliance with the DSC.

- **Imperial Lake Reservoir**

  Imperial Lake is primarily an emergency storage reservoir, however it is very inefficient storage. Provision has been made in 2011/12 for an engineering study into alternative emergency supplies for Broken Hill, with a view to determining future options for this reservoir and its associated pumping station.

5.3.2 Pumping stations

The main electric pumping stations, from Menindee to Broken Hill are:

- Menindee pumping station
- Menindee Booster pumping station
- Kinalung pumping station
- Kinalung Booster pumping station
- Stephens Creek pumping station

The mechanical and electrical pumps, motors and switchgear are subject to regular and periodic rebuild/replacement in order to maintain reliability and efficiency.

5.3.3 Pipelines

The water pipelines servicing Broken Hill are as follows:

Menindee to Broken Hill pipeline

The Menindee to Broken Hill pipeline is the single, most essential pipeline serving water to Broken Hill. A detailed investigation by a pipeline expert was recently conducted on this asset, and preliminary indications are that the pipe is mostly in good condition, however there are a number of sections that have been subject to accelerated corrosion and require replacement. This asset is subject to continual inspection and testing, followed by annual refurbishment of faulty sections.

Umberumberka pipeline

The Umberumberka pipeline is also critically important in providing water to Broken Hill, however this pipeline is in very poor condition, and subject to an accelerated refurbishment program.

Imperial Lake pipeline

The Imperial Lake pipeline is of lesser importance, however the pipeline also feeds a number of customers, and will need to be maintained accordingly.

5.3.4 Water treatment plants

Water treatment plants within Country Water's service area are as follows:

- Mica Street water treatment plant
- Mica Street reverse osmosis plant
- Menindee water treatment plant and chlorination plant
- Silverton chlorination plant
- Sunset Strip water treatment plant

The most significant asset is the Mica Street water treatment plant, serving potable water to the city of Broken Hill. The old plant is being replaced by a new plant, which is expected to be completed in 2009/2010. Forecast capital expenditure for this category is therefore minimal for the regulatory period.

5.3.5 Tanks

Broken Hill is serviced by a number of steel and concrete water tanks that store potable and raw water, ready for reticulation to customers. Significant tank projects include:

- Rocky Hill – build standby tank and refurbish existing tank in 2010/11.
- Mica Street – replace the 100 year old obsolete No 1 tank with new steel tank in 2011/12 and 2012/13.

5.3.6 Water reticulation

Forecast capital expenditure on regular and ongoing mains renewal to replace obsolete and leaking asbestos cement pipes with modern PVC pipes.

5.3.7 Sewerage pumping stations

The mechanical and electrical pumps, motors and switchgear are subject to regular and periodic rebuild/replacement in order to maintain reliability and efficiency.

5.3.8 Sewerage Reticulation

Regular and ongoing capital expenditure to renew sewer mains vents, access chambers and lids, and the replacement of old clay pipes with new PVC pipes.

5.3.9 Sewerage Treatment Plants

Broken Hill has two sewerage treatment plants:

- Wills Street sewerage treatment plant servicing the city north of the Line of Lode, and
- South Broken Hill sewerage treatment plant servicing the city south of the Line of Lode.

Both plants are over fifty years old, and Wills Street in particular has been subject to concrete degradation due to the corrosive effects of sulphuric acid, a by-product of sewerage breakdown. Substantial works are required to keep the plant in safe and efficient operating order. Stage 1 involves extensive refurbishment of Wills Street in 2011/12 and Stage 2 will be completion of the refurbishment works in 2012/13.

5.3.10 Non system capital expenditure

Non-system assets include direct expenditure on information technology systems and hardware, telephones, furniture and fittings and instruments, which are required to support the Country Water business. Country Water's financial system captures and reports non system capital expenditure as part of the corporate allocation that is distributed to the Country Water business. This corporate allocation is consistent with the approved cost allocation method contained in the Australian Energy Regulator's (AER's) New South Wales distribution determination 2009-10 to 2013-14 (the electricity distribution determination).

Therefore, the forecast costs for non system assets for the regulatory period are not individually identifiable, but are included in the forecast capital expenditure categories above.

5.3.11 Asset Disposals

No asset disposals are forecast over the regulatory period.

5.3.12 Capital Contributions

No capital contributions are forecast over the regulatory period.

6 DEPRECIATION

6.1 Depreciation

Depreciation has been calculated on a straight line basis utilising economic asset lives. Country Water has used the following principles in designing the depreciation schedule:

- The assets are only depreciated once over their economic life
- It reflects changes in the economic lives of the assets
- It allows for charges to vary over time in a way that promotes efficient growth in the market

The economic asset lives, remaining lives and written down values for each asset category as at 30 June 2010 are shown in Table 6 below.

Asset Category	Economic Life (yrs)	Remaining Life (yrs)	WDV ($,000 nominal)
Total Assets	82	34	334,861
Water Mains	100	41	117,008
Water Pumping Stations	45	22	12,567
Water Reservoirs	135	44	76,440
Water Reticulation	75	35	32,247
Water Treatment Plants	37	14	49,198
Sewer Pumping Stations	40	18	1,328
Sewer Reticulation	92	39	40,858
Sewer Treatment Plants	40	8	5,217

Table 6 – Economic asset lives, remaining lives and written down values as at 30 June 2010

Table 7 below shows the opening regulatory written down values, weighted average regulatory economic lives, weighted average remaining lives, and the calculated depreciation amounts forecast for the regulatory period.

$,000 (nominal)	Total Economic Life (yrs)	Average Remaining Life (yrs)	WDV 30/06/10	2010-11	2011-12	2012-13
Total Assets	82.4	33.6	334,861	10,261	10,679	11,179

Table 7 – Forecast depreciation for the regulatory period

countrywater

7 REGULATORY ASSET BASE

7.1 Initial Regulatory Asset Base

The initial regulatory asset base as at 1 July 2010 reflects:

- an ODRC value of regulated assets as at 30 June 2009 calculated by GHD and described below in section 7.1.1
- an addition of 2008-09 capital expenditure for the Mica Street water treatment plant which was excluded from the GHD report
- plus estimated capital expenditure to be made in 2009-10
- less estimated disposals to be made in 2009-10,
- less straight line depreciation for 2009-10

Capital contributions have been excluded from the value of the regulatory asset base.

7.1.1 Valuation of regulatory asset base

This regulatory period will be Country Water's first under IPART's regulatory regime. In order to determine Country Water's revenue requirements for the regulatory period it is necessary to establish an initial regulatory asset base in order to determine the return on capital and depreciation components of revenue.

Country Water engaged GHD to undertake an Optimised Depreciated Replacement Cost (ODRC) valuation of Country Water's infrastructure assets and to identify and value selected key facilities to component level (refer to Appendix B). Country Water has used the ODRC valuation for the following reasons:

- Using ODRC provides prices that provide correct economic signals as to the value of the services. Historical cost valuation distorts resource efficiency in that it biases customers away from more modern networks in favour of other alternatives.
- ODRC attempts to replicate the outcome of a competitive market in that it represents "fair value" to both a buyer and a seller of assets.
- ODRC places existing assets on an equal footing with newly constructed infrastructure which are unambiguously valued at construction cost (regardless of optimisation for efficiency) for regulatory purposes.
- Historical cost valuations are heavily influenced by the application of different accounting and capitalisation policies over time. Using ODRC provides consistent valuation of all assets.
- Historical cost valuations make the assumption that the owner has always charged the various customer classes for use of the asset on the basis of accounting depreciation and has always earned a commercial rate of return from each class.
- The optimisation process ensures that current customers do not pay for unused or over specified assets, regardless of their historic cost.
- Historical cost valuations would make any resulting charges dependent on asset age and would lead to price shocks when assets are replaced.

Country Water recognises that consideration of customer impacts is another important issue in deciding the initial regulatory asset base, which has implications for revenue requirements and prices. Assessing the impact on users and service providers is not a mechanistic process, particularly if there are existing cross subsidies between customer classes. Often, the issue is complicated by historical factors, for example past pricing decisions.

To this end, adopting the ODRC valuation would lead to significant price increases for customers. Country Water is very cognisant of this situation and has proposed what it thinks is a realistic and achievable transition of prices to more cost reflective levels. This proposal is discussed in greater detail in section 10 of this submission.

Whilst Country Water recognises that it will not be achievable to receive the allowed rate of return on the full ODRC value of the regulatory asset base, it is extremely important to signal to both present and future customers the true cost of delivering the services provided by Country Water. Therefore, Country Water stresses the need for IPART to adopt an initial regulatory asset base that reflects the ODRC value of the underlying assets and infrastructure, even if this value may not be able to be recovered through prices in the short to medium term.

7.1.2 Asset disposals

Country Water is not aware of any material assets that are expected to be disposed of in 2009-10.

7.1.3 Initial regulatory asset base

The regulatory asset base as at 30 June 2010 is detailed in Table 8 below.

$,000 (nominal)	2009-10
Opening value (ODRC plus Mica St)	300,372
Capex/Additions (excluding cap cons)	30,018
Depreciation	9,257
Disposals	0
Indexation	13,727
Closing value	**334,861**

Table 8 – Regulatory asset base as at 30 June 2010

7.2 The Projected Regulatory Asset Base

The projected regulatory asset base over the regulatory period reflects:

- the opening regulatory asset base as at 1 July 2010, as determined above
- **plus** forecast capital expenditure for the regulatory period from chapter 5
- **less** forecast depreciation for the regulatory period from chapter 6
- **less** the forecast value of water assets to be disposed of in the course of the regulatory period,
- **plus** adjustments for CPI.

7.2.1 Asset disposals

No material asset disposals are forecast over the regulatory period.

7.2.2 The projected regulatory asset base

The regulatory asset base forecast by Country Water for the regulatory period is as follows:

$,000 (nominal)	2010-11	2011-12	2012-13
Opening value	334,861	338,568	348,771
Capex/Additions (net of cap cons)	5,611	12,350	12,308
Depreciation	10,261	10,679	11,179
Disposals	0	0	0
Indexation	8,357	8,532	8,784
Closing value	338,568	348,771	358,684

Table 9 – Forecast regulatory asset base as at 30 June for each year of the regulatory period

8 WEIGHTED AVERAGE COST OF CAPITAL

8.1 Cost of Capital

The appropriate rate of return to apply to Country Water's regulatory asset base is intended to reflect the commercial rate of return that an investor would require, at a minimum, to commit to investing capital into the business.

The rate of return has been determined using the Capital Asset Pricing Model (CAPM) to establish the Weighted Average Cost of Capital (WACC). The WACC has been expressed in pre-tax real terms, consistent with past IPART regulatory decisions, and draws on recent regulatory developments in the national context. Country Water acknowledges that market based parameters will be updated at the time of IPART's final determination to reflect the latest market data and relevant regulatory practices.

8.1.1 Nominal Risk Free Rate

The nominal risk free rate has been determined by Country Water on a moving average basis from the annualised yield on Commonwealth Government bonds with a maturity of 10 years using the indicative mid rates published by the Reserve Bank of Australia. Country Water has adopted a nominal risk free rate of 4.94 per cent observed over the 15 day averaging period ending on 20 May 2009. This rate will be updated over the course of IPART's review process.

8.1.2 Inflation

Country Water has utilised the inflation rate from the AER's recent electricity distribution determination of 2.47 per cent. This is based on an average of the Reserve Bank of Australia's expectations of CPI for the next ten years.

8.1.3 Market Risk Premium

Country Water has utilised Competition Economists Group (CEG) advice on the best approach to calculate the market risk premium in a recent regulatory review (refer to Appendix C). CEG has demonstrated in its report that the market risk premium lies within a range of 6.6 per cent to 11.2 per cent when utilising a gamma of 0.30. For the purposes of this regulatory period, Country Water has adopted a conservative value at the lower bound of the range of 6.5 per cent.

8.1.4 Debt Risk Premium

Country Water has calculated the debt risk premium with reference to the same averaging period that was adopted in determining the risk free rate. Country Water has also used an average of Bloomberg and CBASpectrum data observations in calculating a debt risk premium of 4.7 per cent, based on the approach recommended by CEG in a recent regulatory review (refer to Appendix D).

8.1.5 Equity Beta

Country Water believes that the equity beta for the water business is, on balance, likely to be at least equal to the market as a whole due to its small scale, volatile revenues and reliance on a small number of large customers. Therefore, consistent with the range adopted by IPART in past decisions, Country Water has adopted a conservative value for equity beta of 1.00.

8.1.6 Summary of WACC parameters

Country Water acknowledges that market-based parameters including the risk-free rate, inflation and debt margin will need to be updated at the time of Country Water's final determination to reflect prevailing market conditions. Based on the assumptions above, Country Water considers the parameters in Table 10 are appropriate for the regulatory period. For the purpose of this submission the revenue requirements have been calculated adopting a real pre-tax WACC of 8.88 per cent.

WACC Parameter	Parameter Value (%)
Nominal risk free rate	4.94%
Inflation	2.47%
Real risk free rate	2.41%
Market risk premium	6.50%
Debt risk premium	4.70%
Debt to total assets	60.00%
Equity Beta	1.00
Real pre-tax WACC	8.88%

Table 10 – WACC parameters adopted for the regulatory period

8.2 Return on Capital

The return on capital component of the building block has been calculated as follows:

$,000 (nominal)	2010-11	2011-12	2012-13	2013-14	2014-15
Return on Capital	29,095	29,705	30,582	29,095	29,705

Table 11 – Forecast return on capital calculation for the regulatory period

9 OPERATING EXPENDITURE

9.1 Overview

Forecast operating expenditure is consistent with the operating expenditure that would be incurred by a prudent service provider to efficiently provide water and sewerage services, in accordance with accepted and good industry practice to achieve the lowest sustainable cost of delivering these services.

9.2 Forecast Operating and Maintenance Expenditure

Country Water has used the 2009/10 budget as the base for projecting forecast operating expenditure over the regulatory period.

Country Water recognises that operating and maintenance requirements change during a regulatory period for a range of reasons including, changes in consumption patterns, inflation, real wage growth, and real cost increases in materials and equipment.

The incremental rate of change in operating expenditure expected over the regulatory period, due to the impact of these factor changes, can be adjusted annually according to the formula:

$Opex_{t+1} = Opex_t * (1+F+G)$

Where:

- F is a real wage and material cost growth factor
- G is a network growth factor

Real wage and material cost increases

It is necessary to determine a price index relevant to the inputs employed in operating and maintenance activities. For this regulatory period, Country Water has presented the expenditure forecasts in real terms including market expectations of real wage and material cost increases, consistent with accepted regulatory practice (refer to Appendix E and the AER's electricity distribution determination).

Network growth

Country Water has applied the forecast water consumption growth rate to each operating expenditure category in recognition that growth in utilisation of assets will lead to increased maintenance expenditure, and this reflects the marginal cost associated with providing the additional output.

Table 12 below shows Country Water's forecast level of operating expenditure over the regulatory period, with detailed descriptions of each category contained in the sections following.

$,000 (real 2009-10)	2010-11	2011-12	2012-13
Corporate Support	3,143	2,268	2,319
Mains	260	237	241
Reservoirs	535	486	495
Pipelines	651	592	603
Pumping Stations	3,681	3,347	3,410
Reticulation	2,690	2,446	2,492
Treatment Plants	4,731	4,301	4,382
Debt raising costs	163	160	161
Total Operating Expenditure	**15,856**	**13,837**	**14,103**

Table 12 – Forecast operating expenditure for the regulatory period

The operating expenditure categories are described below in greater detail.

9.2.1 Corporate Support

Corporate services that provide necessary support to Country Water are allocated consistent with the Australian Energy Regulator approved cost allocation method. Forecast operating expenditure for Country Water includes an efficient share of corporate support costs.

Corporate support functions are described below.

Finance – These costs cover the financial and management accounting services, taxation and treasury functions including accounting, management reporting and operational cost analysis, audit fees, accounts payable, payroll and general financial reporting.

Information Technology and Telecommunications – These costs cover major information technology systems built to facilitate retail market competition, financials, CIS and a host of other information technology applications. It also includes the maintenance and software upgrades on general personal computers for the distribution business. There is also an allocation of all telecommunication costs. These costs include radio communications and telephones.

Regulatory and Compliance – These costs are incurred to meet regulatory, environmental and industry compliance requirements. It includes the costs associated with preparing regulatory accounts and audits, preparing regulatory proposals, and other industry, technical regulatory reporting and compliance requirements.

Human Resource Management and Development – These costs cover the human resource management and administration including policy development, monitoring, recruitment and training.

Environmental and Safety Management – These costs are associated with coordinating the development of corporate environmental and Occupational Health and Safety policies and procedures, liaising with government agencies and managing corporate environmental and safety reporting.

Property Management – These are the costs associated with the management of properties including general maintenance and upkeep (cleaning, gardening, waste collection, and general maintenance) of office and depot sites, and any rental fees.

Other Corporate Costs – Costs associated with executive management and administration, company secretary, corporate governance, stakeholder relations and communications, legal services, business development and strategic development and planning.

9.2.2 Mains and Pipelines

Water - Operational requirements include patrol and inspection, specialised testing and recording (wall thickness due to corrosion, pressure and flow measurements), inspection of cathodic protection equipment, noting and logging cathodic protection instrument readings, programmed maintenance including replacement of sections of pipe, patches, and repairs or replacement of concrete chairs. Maintenance also includes emergency and planned repairs and replacement of pipe sections.

Sewerage – Expenditure includes patrol and inspection, clearing blockages and cleanout with high pressure jet and vacuum pumps, emergency and planned repairs and replacement of pipe sections.

9.2.3 Reservoirs and Tanks

Water reservoirs only – These costs cover inspection, measurement and recording of water levels and quality, inspections and reports associated with dam maintenance, keeping surrounding catchments clear of weeds, tree growth and obstructions. Expenditure also includes inspection and maintenance of associated plant, valves, pipes, buildings and fences.

Water tanks only – Costs associated with inspection and reporting on tank condition, inspection of cathodic protection equipment, noting and logging cathodic protection instrument readings, periodic tank cleanout and inspection and maintenance of associated plant, valves, pipes, buildings and fences. Tanks periodically require draining, sandblasting and relining, as well as exterior painting and repairs to corroded equipment such as hatch covers.

9.2.4 Pumping Stations

Water – Costs include inspection, testing and measurement of the condition of electrical and mechanical equipment. Measurements include pump pressures, flow rates efficiency, vibration, and tolerances. Other costs involve repairs to failed plant, lubrication and service of mechanical and electrical plant, inspections, testing and reporting on ancillary services, such as building lights and power, fire fighting equipment, security and communications equipment. Building and grounds maintenance, station operational requirements, changeover pumps, open/close valves and electricity consumption to operate pumps are covered in this category.

Sewerage – Costs are similar to water but on a smaller scale, and involve additional clearance of blockages and cleanout with high pressure jet and vacuum pumps.

9.2.5 Reticulation

Water – Costs associated with patrol, inspection and testing (especially for leaks), emergency and planned repairs, systematic operations of reticulation apparatus, valves, and hydrants. Periodic cleanout of pipes with high pressure air injection also falls under this category.

Sewerage – Costs include patrol, inspection and testing (especially for root invasion), emergency and planned repairs, systematic operations of reticulation apparatus, valves, and hydrants. Clearance of blockages and cleanout with high pressure jet and vacuum pumps are also included.

9.2.6 Treatment Plants

Water - The water treatment plant is operated on a 24/7 basis, with the operators setting and monitoring pumping and filtration schedules from the control room, keeping extensive records, as well as operating machinery and plant within the treatment plant. This includes all duties associated with pumping filtration and dosing water to achieve Australian drinking water quality guidelines.

Other costs include inspection, testing and measurement of the condition of electrical, mechanical chemical and filtration equipment. Measurements include filtration and pump pressures, flow rates efficiency, vibration, and tolerances. Repairs to plant failure, lubrication and service of mechanical and electrical plant are covered by this category. Further costs are in the form of building and grounds maintenance, inspection, testing and reporting on ancillary services, such as building lights and power, fire fighting equipment, security and communications equipment. Treatment plant operational requirements, changeover pumps, open/close valves and electricity consumption to operate pumps are included in this category.

Sewerage - The Wills Street plant is manually operated throughout normal working hours, with the operators scheduling, controlling, and switching the pumps, filters, and digesters, as well as removing and storing sludge from tanks to drying beds, and final storage locations. Costs cover similar items to water but on a smaller scale.

9.2.7 Debt Raising Costs

Country Water has adopted a conservative approach and included total debt raising costs of 8.1 basis points per annum for the regulatory period, consistent with accepted regulatory practice. The projected debt raising costs for each year over the regulatory period is summarised in Table 13 below.

$,000 (real 2009-10)	2010-11	2011-12	2012-13
Debt raising costs	163	160	161

Table 13 – Debt raising costs for the regulatory period

9.3 Forecast and Historical Operating and Maintenance Expenditure Comparisons

The table and figure below present Country Water's forecast operating expenditure compared to actual historical operating expenditure dating back to the 2006-07 financial year. Both representations illustrate a declining trend in operating expenditure and, that in total, forecast operating expenditure is expected to be below historical levels on an average annual basis.

Category ($,000 2009-10)	Average 2006-07 to 2008-09	Average 2009-10 to 2012-13
Water Operating Expenditure		
Corporate	2,492	2,198
Installation Inspection	121	-
Quality of Supply Invest Standards	479	-
Reservoirs	479	477
Water Pipelines	407	581
Water Pumping Stations	2,779	2,906
Water Reticulation	2,263	1,701
Water Treatment Plant	2,882	3,166
Total Water Operating Expenditure	**11,902**	**11,030**
Sewerage Operating Expenditure		
Sewerage/Effluent Mains	72	232
Sewer Pumping Stations	306	379
Sewer Reticulation	738	700
Sewer Treatment Plants	1,225	1,056
Total Sewerage Operating Expenditure	**2,342**	**2,367**
Total Operating Expenditure	14,243	13,397

Table 14 – Comparison of average annual operating expenditures

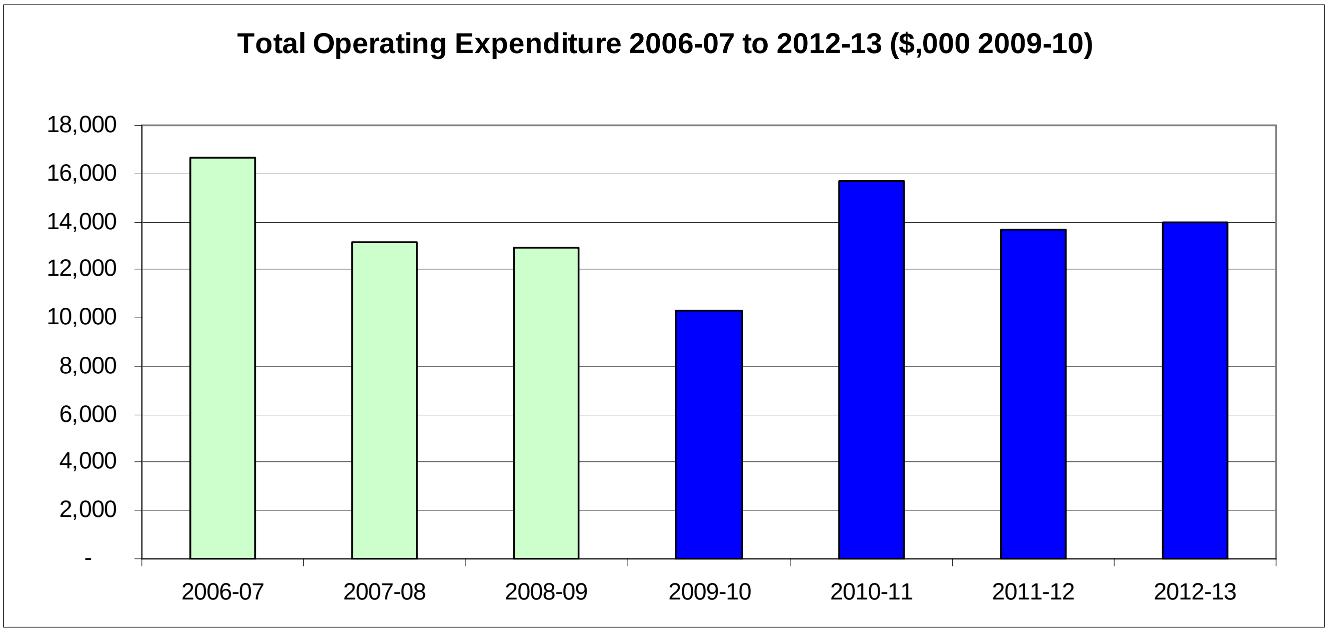

Figure 4 – Country Water operating expenditure 2006-07 to 2012-13

10 APPROACH TO DETERMINING PRICES

10.1 Overview

For this review, Country Water seeks to achieve a positive commercial outcome to ensure the efficient delivery of services at required levels, allow for targeted investment, ensure the ongoing commercial viability of the business, and provide a fair and reasonable return for our shareholder. Country Water accepts the need to manage impacts on customers. We believe that the options presented in this submission achieve a reasonable and acceptable balance between all stakeholders.

As this is the first time a regulatory review process has been undertaken for Country Water, an important component of IPART's decision will be the cost building blocks used to calculate the revenue requirement. Given that this will likely be the only opportunity Country Water will have to establish the correct value of its regulated water and sewerage assets, Country Water strongly argues that the regulatory asset base and cost building blocks should be set to the correct value initially so that the true cost of service can be made transparent to all stakeholders. Any customer impacts can be managed through other means including transitional pricing and side constraints on prices.

The form of price control historically used by IPART for water businesses is a schedule of fixed prices for each year of the regulatory period based on the expected demand for services over that period against the revenue requirement calculated using the building block approach. Due to the minimal growth expected for water and sewerage services, Country Water proposes the use of a revenue cap with an unders and overs account. This will ensure Country Water can recover its maximum allowed revenue regardless of the actual demand experienced throughout the regulatory period.

10.2 The rate of return approach

IPART has indicated in the Issues Paper that cost based approaches have generally been adopted for the water utilities it regulates. Of the cost based approaches utilised by IPART, Country Water gives preference to the rate of return approach – commonly referred to as the 'cost building block' approach.

The approach requires a view to be formed on a number of essential components. They include:

- The opening value of the regulatory asset base;
- The cost of capital financing, including WACC and regulatory depreciation; and
- Projections of capital and operating and maintenance expenditure.

A revenue requirement is then determined based on these components. The revenue requirement can be different to the maximum allowed revenue depending on the transitional pricing approach adopted. Country Water's proposed transitional pricing approach is discussed below.

The preceding sections of this submission laid the foundations for establishing these components for the regulatory period and the derived elements are set out in Table 15 below.

$,000 (nominal)	2010-11	2011-12	2012-13
Return on Capital	29,095	29,705	30,582
Return of Capital	9,714	10,110	10,584
Operating Expenditure	16,248	14,531	15,177
Unsmoothed Annual Revenue Requirement	55,057	54,346	56,342

Table 15 – Forecast unsmoothed annual revenue requirements for the regulatory period

10.3 Revenue cap

In its issues paper, IPART provided a number of approaches for setting and regulating tariffs for services. Country Water supports a revenue cap approach to tariff setting. Country Water would determine tariffs annually to ensure that total revenue from tariffs did not exceed the maximum allowed revenue.

Country Water also supports the inclusion of an unders and overs account to manage differences in actual revenue compared to the maximum allowed revenue. These differences can result when there are variations between actual and forecast water consumption and demand.

10.4 Transitionary pricing approach

Country Water acknowledges that there is a substantial difference between the annual revenue requirement and the actual annual revenue currently collected by Country Water. As discussed previously, Country Water strongly argues that the regulatory asset base and cost building blocks should be set to the correct value initially so that the true cost of service can be made transparent to all stakeholders, but accepts the need to manage price impacts on customers. Country Water is proposing a pricing package which aims to deliver a reasonable and acceptable balance for all stakeholders.

10.5 Calculating price changes

A fundamental design issue in any transitionary pricing approach is the determination of the X factor applied to smooth the revenue requirements established by the building blocks.

The cost building block revenue requirement will vary according to capital expenditure and operating expenditure forecasts. In order to reduce variations in annual revenues and to limit adverse price impacts for customers, the raw revenue requirements should be smoothed. CPI-X plays an important role in providing such a smoothing mechanism, where the X factor represents the annual variation in average prices to customers.

In establishing X factors, IPART must balance the objectives of ensuring that water utilities are able to, or are transitioning to, recover efficient costs and achieve an appropriate rate of return, while providing some acceptable price stability in the transition from one current regulatory period into the next..

On reviewing the cost building block revenue requirement, Country Water considers that the implied price change in moving from the 2009/10 revenue base to the first year of the new regulatory regime would place an unreasonable burden on customers to absorb in one step. Country Water recommends ‘sculpting’ this price impact across the next and future regulatory periods.

The following figure provides a number of options which illustrate the revenue profile of various transitionary pricing approaches.

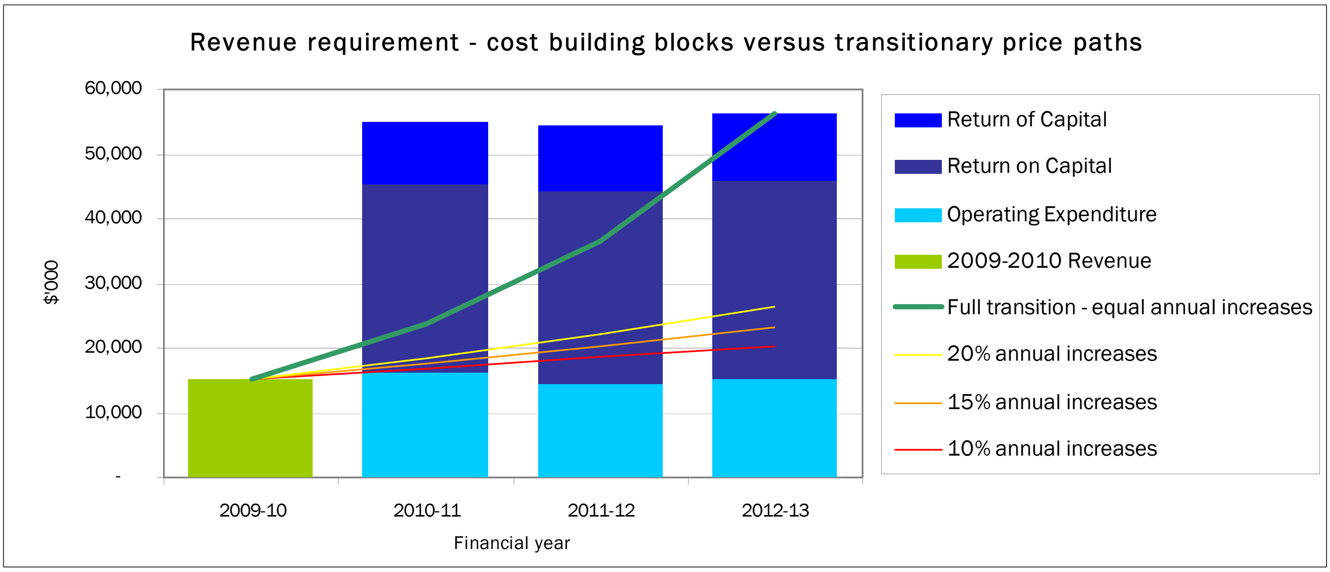

Figure 5 – Transitionary price path options

10.6 Proposed price smoothing approach

Country Water has given much consideration to a transitional approach to a higher revenue base, in light of the potential impact on customers. Price changes fully reflecting cost and revenue requirements, if implemented in a single step, would not be in the overall interests of the community.

Country Water has proposed a transitionary price smoothing mechanism which would limit the impact of full step adjustments within the next regulatory period, while acknowledging the need for further price adjustments in subsequent regulatory periods.

Country Water would welcome the opportunity to further discuss this transitionary pricing approach with IPART.

10.7 Tariff Structures

The proposed structure of water and sewerage tariffs will remain fundamentally unchanged from the current tariffs in place – the tariff for the water service will comprise of a monthly fixed charge plus a volumetric charge based on actual water deliveries.

Customer billing is undertaken on a quarterly basis. Customer bills are based on applicable water and sewer availability and usage charges.

Usage charges are based upon meter readings of customer water service meters, with the billing period relating to the number of days between meter readings. Billing periods that span across different charging periods use a pro-rata of the number of days in each period with usage charges applied accordingly.

Availability charges are an annual charge, levied on a daily basis, with the total charge based upon the number of days in the billing period.

Other charges, such as liquid trade waste and miscellaneous charges are billed according to the customer on an as incurred basis.

Water Availability Charge

The water availability charge is an annual charge to customers and is independent of the level of consumption. The charge is determined by the size (diameter) of the water service from the main, as identified by the size of the meter. Charges are fixed for a financial year period and charged on a daily basis.

The majority of residential customers have a standard 20mm service and pay a uniform water availability charge. For customers who have larger meter sizes, in particular non-residential customers, the water availability charge increases as the meter size increases. The schedule of water availability charges is the same across all of the water reticulation service areas. For vacant land adjacent to an available reticulation system main, the water availability charge is determined each year as a fixed amount.

A water availability charge is applied to all properties other than those identified as exempt properties under Schedule 4 of the Water Management Act 2000.

Water Usage Charge

The water usage charge is based on a customer's consumption of water through the water meter service. Charges are applied dependant on the water product type and the period of consumption in the year.

The water usage charge for the majority of residential and non-residential customers is an inclining block tariff with the first tier charge based on metered water consumption up to 1.096kL per day, and the second tier charge based on consumption greater than 1.096kL per day. During the summer period, identified as a 114 day period starting on the 1st December each year, the first tier charge is based on consumption up to 1.645kL per day, and the second tier charge based on consumption greater than 1.645kL per day.

Sewer Availability Charges

The sewer availability charge is an annual charge to customers and is independent of the level of usage. Charges are fixed for a financial year period and charged on a daily basis.

The residential sewer availability charge is a uniform annual charge. The non-residential sewer availability charge is determined by the size (diameter) of the water service from the main, as identified by the size of the water meter and increases as the size of the water service increases and reflects the load that can be placed on the sewerage system. For vacant land adjacent to an available sewer system main, the sewer availability charge is determined each year as a fixed amount. A sewer availability charge is applied to all properties other than those identified as exempt properties under Schedule 4 of the Water Management Act 2000.

Sewer Usage Charge

A sewer usage charge is applied to non-residential properties and is charged based on an appropriate Sewerage Discharge Factor (SDF), reflective of the customer impact on the sewerage system, multiplied by the metered consumption of treated water through a water meter service. The sewer usage charge is a uniform rate for non-residential sewerage customers.

Trade Waste Charges

A range of *charges* relating to the provision of trade waste services are described in Section 3.3.

10.8 Addition and Deletion of Tariffs

Country Water does not have any plans to amend its tariff structure at this time, and has therefore not included any provision for adding new tariffs or deleting current tariffs.

10.9 Pass through events

Country Water believes that pass through events are an important component of any regulatory framework. However, Country Water is not proposing any pass through events in this submission due to the substantial gap between current actual revenues and the forecast revenue requirement. As previously discussed, the cost building block revenue requirement is substantially above 2009-2010 revenue and is likely to be substantially above the revenue base in the last year of the regulatory period. Country Water accepts the need to manage impacts on customers and given the significant under recovery, additional revenue increases to the transitionary increases resulting from pass through events would place an unreasonable burden on customers.

11 OTHER MATTERS

11.1 Length of Regulatory Period

Country Water is proposing a regulatory period of three years commencing 1 July 2010 and ending on 30 June 2013. Country Water believes this is a suitable regulatory period in this instance as it coincides with the expiration of the current NSW Government's subsidy funding arrangements for Country Water. Country Water also notes that IPART has accepted three year regulatory periods in the past for practical and certainty reasons.

12 GLOSSARY

Unless the context otherwise requires, the following expressions have the following meanings when used in this submission:

AER Australian Energy Regulator

Business day A day other than a Saturday, Sunday or a declared public holiday in New South Wales

CAPM Capital Asset Pricing Model

CEG Competition Economists Group

Change in the CPI for a *Year* t means the average of the *CPI* for the four quarters to the December quarter immediately preceding that *Year* divided by the average of the *CPI* for the four quarters to the December quarter immediately preceding *Year* t-1

CPI Consumer Price Index: All Groups, index number weighted average of eight capital cities published by the Australian Bureau of Statistics for time to time and if the Australian Bureau of Statistics ceases to calculate and publish such an index then *CPI* will mean any index that substantially replaces that index

Department NSW Department of Water and Energy

DSC NSW Dam Safety Committee

GL Gigalitre

IPART The Independent Pricing and Regulatory Tribunal of New South Wales

kL Kilolitre

Laws All laws including statutes, regulations, licenses, authorisations and codes as well as any determinations of any governmental agency under such laws applying from time to time

ML Megalitre

NIEIR National Institute of Economic and Industry Research

RBA Reserve Bank of Australia

Regulatory Period 1 July 2010 to 30 June 2013

Residential Customer A customer who uses water primarily for domestic purposes

SDF Sewerage Discharge Factor

WACC Weighted Average Cost of Capital

Year Each twelve month period from 1 July to 30 June

13 APPENDICES

13.1 Appendix A – NIEIR Water Consumption Forecasts Study (Confidential)

13.2 Appendix B - GHD Report for Asset Valuation (Confidential)

13.3 Appendix C - CEG The Market Risk Premium and Relative Risk for Country Energy (Confidential)

13.4 Appendix D - CEG Estimating the Cost of 10 year BBB+ Debt

13.5 Appendix E – CEG Escalation Factors Affecting Expenditure Forecasts

14 IPART ISSUES PAPER CHECKLIST

In preparing its submission, Country Water has considered the matters raised by IPART in its Issues Paper. The table below presents the submission reference of where each of the questions raised in the Issues Paper are addressed by Country Water.

Issue	Addressed in Section
1 What are customer's needs in the provision of water and sewerage services	Chapter 3
2 What is the most appropriate suite of mechanisms for IPART to adopt to fix Country Water's maximum prices for water and sewerage services	Chapter 10
3 Country Water's projected operating expenditure as outlined in its submission (due 11 September 2009)	Section 9.2
4 Country Water's projected capital expenditure program as outlined in its submission (due 11 September 2009)	Section 5.3
5 Country Water's asset management framework, and the relationship between its asset management framework and capital expenditure program	Section 5.1
6 Country Water's proposed methodology for the calculation of depreciation, assessment of asset lives and the assumptions used to determine these	Chapter 6
7 Subsidies and contributed assets received by Country Water	Chapter 11, Section 5.3.12
8 The length of the determination period that should apply for this determination	Section 11.1
9 Is Country Water compliant with its regulatory obligations and what are the implications for prices of compliance with current and proposed obligations	Section 3.5, Chapters 5,9,10
10 Country Water's projected customer numbers and sales (as outlined in its submission)	Chapter 4, Appendix A
11 The appropriate level and structure for Country Water's water and sewerage prices including views on the current inclining block tariff structure	Chapter 10
12 The appropriate levels and structures of charges for Country Water's treated effluent water, chlorinated water, untreated water, trade waste, and ancillary and miscellaneous services	Chapter 10
13 The impact of Country Water's proposed prices (as outline in its submission) on customer groups	Chapter 10
14 What contribution should future charges levied on water and sewerage customers make to the cost of service provision and what are the implication for service level and social impacts	Chapter 10

Table 16 – IPART Issues Paper checklist submission references

Estimating the cost of 10 year BBB+ debt

A report for Country Energy

Tom Hird

June 2009

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1. Terms of reference

1. Country Energy has asked me to advise on an appropriate method for estimating the cost of issuing debt with ten year maturity and a credit rating of BBB+ from Standard and Poor’s. In particular, Country Energy has asked that I advise on the relative merits of fair value estimates published by Bloomberg and CBASpectrum and on potential alternative estimates.

2. Criteria for estimating the cost of

2.1. General criteria

2. In my view a methodology for estimating the cost of debt should as far as possible:

   i. result in an unbiased estimate of the cost of issuing debt and a small standard error (ie, when the method does misestimate the benchmark rate it should only do so by a small amount);
   ii. incorporate all relevant information and not rely on irrelevant information;
   iii. produce results that are consistent with accepted academic finance theory and empirical research;
   iv. produce results that are timely and responsive to changes in market conditions; and
   v. be transparent including transparency about how and to what end discretion has been employed.

2.2. Relevant economic issues

3. In this report I will present evidence and discussion of how one would estimate the interest rate that would typically be incurred by a firm issuing a bond that has:

   - no put/call/conversion options attached to it;
   - a maturity of 10 years where the issuer makes fixed payments to the bond holder over the ten years and those payments are denominated in Australian dollars; and
   - a credit rating of BBB+ from Standard and Poor's.

4. For these type of bonds, there are other features that may affect its yield. These include:

   - whether the coupon payment is high or low. The higher the coupon payment the shorter the "duration" being the average timing of payments associated with the bond. For a "bullet" bond with a single payment at the time of maturity and no intervening coupons then the duration of the bond is equal to its maturity. For all other bonds the duration is shorter than its maturity. If the yield curve is upward sloping then, other things equal, for two bonds with identical maturity the bond with the shorter duration will have a lower yield to maturity – reflecting the fact that shorter duration bonds pay more of their value in earlier periods (over which the required yield to that point in time is lower when the yield curve is upward sloping);

- whether there is likely to a liquid[1] secondary market for the bond. The more liquid the secondary market for a bond the more attractive will be the bond at the time of issuance (lower the yield to maturity) because investors will know that the cost of selling the bond, should they need to do so in the future, will be lower; and
- whether the probability of default for a bond is higher or lower than the average for bonds with a BBB+ rating.

5. I will assess different estimates of the cost of debt against a 'benchmark rate' where that benchmark rate reflects and 'average' of bonds with differing duration, liquidity and default risk but which nonetheless have a BBB+ rating.

6. Finally, it is relevant to note that the cost of debt to a firm is the interest rate incurred by the firm at the time of issue. There are sound economic reasons for believing that the interest rate at which bonds trade at in the secondary market will be lower than the interest rate at which those bonds are issued initially (other things constant). This reflects the fact that the initial sale of the bonds represents the sale of 100% of the relevant bonds over a short period (often over a single day in a book build process). By contrast, secondary trades of the bond are almost always for much smaller parcels of the bond (a few percent of the total amount outstanding). Unless the corporate bond market is perfectly liquid then an initial sale of a large volume of bonds will always, other things equal, result in a lower bond price (higher yield) than subsequent secondary sales.[2]

7. Of course, determining the actual level of this premium is very difficult because it is very rare for an investor to participate in an initial bond sale and then immediately turn around and sell that bond in the secondary market. By the time secondary market sales are recorded it is not possible to know definitively whether the price change reflects a new issue premium or other factors that have affected the cost of debt since the initial issue was made.

2.3. Consideration of current market conditions

8. Following the onset of the global financial crisis, the market for corporate bonds has changed materially. The impacts of these changes are summarised in the below quotes from various sources:

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1 A liquid secondary market is one where a buyer or seller could, over a short period, accumulate/liquidate a large value of the relevant asset without raising/depressing its price.

2 Of course, this does not mean that the first secondary trades after an initial issue will always occur at a lower yield to maturity. Changes in market conditions between the time of initial issue and the time of subsequent secondary trade may cause the observed yield on some secondary trades to be higher than the yield at time of issue.

9. Before the crisis was fully developed the International Monetary Fund (IMF) stated in April 2008:

> *"The financial market crisis that erupted in August 2007 has developed into the largest financial shock since the Great Depression, inflicting heavy damage on markets and institutions at the core of the financial system,"*[3]

10. Since then, the crisis has progressed further and reached a new level in September 2008.[4] The IMF in its October 2008 World Economic Outlook clearly identified the events of September 2008 as signalling a 'new phase' for the crisis:

> *"The financial crisis that first erupted with the U.S. subprime mortgage collapse in August 2007 has deepened further in the past six months and entered a tumultuous new phase in September. The impact has been felt across the global financial system, including in emerging markets to an increasing extent. Intensifying solvency concerns have led to emergency resolutions of major U.S. and European financial institutions and have badly shaken confidence."*

11. Similarly, the Organisation for Economic Cooperation and Development (OECD) states in the context of its November 2008 Economic Outlook No. 84:

> *"This Economic Outlook represents a substantial downward revision from just a few months ago: many of the downside risks previously identified have materialised. The financial turmoil that erupted in the United States around mid-2007 has broadened to include non-bank financial institutions and rapidly spread to the rest of the world. Following the collapse of Lehman Brothers in mid-September, a generalised loss of confidence between financial institutions triggered reactions akin to a 'blackout' in global financial markets."*[5]

12. An important consequence of this is that there has been a significant flight of capital to the safety and liquidity of nominal Government bonds. This has been described by the US Federal Reserve as an "extreme rush to liquidity".

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3 IMF, World Economic Outlook, April 2008 page xv.

4 On the 7th of September the two largest buyers and securitisers of US mortgages ('Fannie Mae' and 'Freddie Mac') were placed in conservatorship. On Sunday 14th September the bankruptcy of investment bank Lehman Brothers and the sale of Merrill Lynch to Bank of America (with US government guarantees attached) were both announced. On Tuesday the 16th of September it was announced that the US Government would effectively take over 80% of the equity in one of the world's largest insurers (AIG) which had suffered a liquidity crises and was unable to find lenders to save it from insolvency. The US Government provided an $85 billion credit facility in exchange for taking over 80% of the equity in AIG.

5 OECD, Economic Outlook No. 84, Editorial, Managing the global financial crisis and the economic downturn and summary of projections, Klaus Schmidt-Hebbel, OECD Chief Economist, page 3.

"We have discontinued the liquidity-adjusted TIPS expected inflation estimates for the time being. The adjustment was designed for more normal liquidity premiums. ***We believe that the extreme rush to liquidity is affecting the accuracy of the estimates.****"*[6]

13. Australian credit markets have been similarly affected. Deloitte in a November 2008 report for the AER has stated:

The market for non-financial institutions corporate bonds, similar to the assumed BBB+ grade used in the WACC model, effectively vanished from capital markets in the first half of 2008 against a total for $6.5 billion for the whole of 2007[7]

The small volume of corporate bond issues that has taken place in 2008 has been in the main restricted to large financial institutions, and credit spreads have increased significantly

In the past, 5 and 10 year bonds were widely issued, but in the current market, the little volume that is being issued is primarily 3 year bank debt, with very little liquidity in 5 year facilities.

In the current market it would be difficult (if not impossible) to attempt to refinance billions of dollars of debt in a 5-40 day [sic]

From published research and discussions with market makers, the expectations are for the domestic corporate bond market to remain illiquid, possibly into 2010 and beyond. Given the historic events in credit markets, market makers were reticent to make any predictions… Their expectations are for the corporate bond market to have a very slow recovery, particularly for BBB+ issuances.[8]

As per discussions with Market Makers there is currently no liquidity in the domestic corporate bond market, and international banks and fund managers are withdrawing funds from the market, restricting the size of the pool of money available to invest.

The recent financial crisis demonstrates that in times of severe market conditions, liquidity in the primary and secondary markets can decline or even disappear. The lack of liquidity in the primary debt market implies business entities cannot raise finance via debt issuance without paying higher borrowing

6 http://www.clevelandfed.org/Research/data/TIPS/lpremium.cfm.

7 Page 5.

8 Page 9.

costs… On the other hand, the lack of liquidity in the secondary market implies capital providers in the primary market (investors) cannot convert debt securities to cash quickly at reasonable prices and hence would demand a higher rate of return from investments in the debt market. In both cases, the lack of liquidity will result in the addition of a liquidity premium to the investors' required rate of return and hence will increase the costs of accessing debt.[9]

14. Similarly, the Reserve Bank of Australia's (RBA) November Statement on Monetary Policy states:

"World financial markets have come under severe stress in the period since the last Statement [in August 2008]. Strains in credit markets escalated in early September, and the period since then has been marked by further large declines in equity prices and exceptional volatility across a range of markets…

The renewed turmoil was sparked by the failure or near-failure of a number of financial institutions in the United States and Europe…

These events saw an intensification of the credit tightening that was already beginning to take hold in a number of countries. While this had previously been mainly apparent in increased funding costs, which were typically passed on to borrowers in the form of higher lending rates, the renewed turmoil saw this develop into a serious tightening in credit availability. As confidence in the financial sector deteriorated, banks became more uncertain about their ability to sustain their funding, and this in turn made it more difficult for them to lend to sound borrowers in the non-financial sector.[10]

The deterioration of credit market conditions and the failure of several large financial institutions saw corporate debt yields increase significantly through September and October as default risk concerns escalated. Spreads on corporate debt surpassed their mid-March highs and 2000 peaks…[11]

Corporate bond issuance in the United States was very weak in the September quarter and well below the already subdued level of issuance seen earlier in 2008; issuance was around three times less than in the June quarter for both financials and non-financials, reflecting the current very difficult conditions for longer term funding.[12]

9 Page 18.

10 RBA, *Statement on Monetary Policy*, 10 November 2008, page 1.

11 Ibid, Page 13.

12 Ibid, page 14.

15. The RBA's February 2009 statement noted:

> *While the global financial system remains under considerable strain, there have been some signs of an improvement in financial conditions recently. The extreme volatility that affected all markets in October and November following the Lehman's collapse has abated in the past two months. There have also been some signs of improvement in the functioning of credit markets in response to the substantial assistance measures taken by authorities in a number of the major economies. These measures have included injections of capital into financial institutions, the provision of government guarantees and various actions taken by central banks to improve market liquidity. While spreads in money markets remain high, yields have fallen to historically low levels in many countries. Debt issuance at longer terms has picked up, dominated by bonds issued by banks using government guarantees…*[13] *However, global issuance of unguaranteed debt remains weak."*[14]

16. In a speech on 31 March 2009,[15] the RBA Assistant Governor (Financial Markets) commented on the effects of the global financial crisis on Australian financial markets as follows:

> *"Funding markets shut completely following the collapse of Lehman Brothers [in September 2008]. All global financial markets were dislocated by this event, but not surprisingly term debt markets were about the most affected…*
>
> *In the wake of the dislocation induced by Lehman's, many countries, including Australia, moved to guarantee bank debt issuance. Soon after the introduction of the guarantee, Australian banks were able to once again access term debt markets… There has, however, been little investor appetite for unguaranteed debt, despite other indications of an improvement in credit market conditions."*

17. In summary, the current conditions in the secondary market for corporate bonds (which is the market covered by Bloomberg and CBASpectrum) are such that:

- there are few, if any, actual transactions in the secondary bond market;
- there are no long dated BBB+ fixed coupon bonds and there have been very limited issue of new bonds (especially at the BBB+ credit rating); and

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13 RBA, *Statement on Monetary Policy,* 6 February 2009, page 1.

14 Ibid, page 22.

15 Speech titled *Some Effects of the Global Financial Crisis on Australian Financial Markets,* delivered by Guy Debelle, RBA Assistant Governor (Financial Markets) to Finance Professionals Forum, Sydney, 31 March 2009.

- there is very low liquidity (in the sense that it is difficult to buy and sell without affecting prices) and there is a high premium associated with liquidity.

18. I discuss these conditions in turn below and identify the issues that they raise for estimating an average benchmark yield on 10-year, BBB+ corporate debt. I use the term "the benchmark rate" as a short hand for this concept.

2.3.1. Few trades in corporate bonds

19. As noted above, I understand that there are currently few, if any, actual transactions in the secondary bonds market. In any case, given that such bonds are not generally traded in a centralised exchange but are bought and sold 'over the counter' it can be difficult to observe the prices on the trades that actually take place.

20. Both Bloomberg and CBASpectrum source pricing data from a range of contributors such as banks and brokers that arrange trades in bonds. However, I understand that they do not, in general, distinguish between 'indicative prices' quoted by the source and 'executable prices' that are the result of an actual trade. There is no guarantee that the price attributed to a bond by either of the services will represent the results of actual trading. Indeed Bloomberg has stated in 2007, before the full onset of the financial crisis, that up to 90% of the prices in its bonds database were indicative, not executable.[16] In a very real sense therefore, the prices reported by both Bloomberg and CBASpectrum represent, to a large extent, the informed opinion of industry players about a fair price for a particular bond.

21. It comes as no particular surprise then, to note that the prices and yields that Bloomberg and CBASpectrum estimate are very different, even for the same bonds. This is likely to be reflective of the extent to which these services collect their pricing data from different sources. I sampled prices reported by Bloomberg and CBASpectrum on 6 May 2009 and observe that the yields reported by Bloomberg are generally, although not universally, lower than those reported by CBASpectrum. A comparison of BBB+ bonds that are covered by both services is shown in Table 1 below.

16 Bloomberg, *Bloomberg Fair Value Market Curves*, International Bond Market Conference, Taipei, 2007.

Table 1: Comparison of estimated yields on BBB+ bonds, Bloomberg and CBASpectrum

Issuer	Maturity	Bloomberg	CBASpectrum
Dexus	04/02/2010	6.331	6.510
Snowy (wrapped)	25/02/2010	5.924	7.719
Bank of Queensland	02/12/2010	6.052	5.870
Dexus	08/02/2011	6.309	7.960
Tabcorp	13/10/2011	6.639	7.440
Coles	25/07/2012	7.445	7.000
Snowy	25/02/2013	7.461	9.260
Santos	23/09/2015	7.968	8.920

Source: Bloomberg, CBASpectrum

22. The fact that there are few if any recent trades in these bonds and that it is not possible to know what the prices were for any trades that actually occurred means that one must rely on observed estimates of prices that would exist if there were trades. Naturally it is very difficult to 'test' the accuracy of such estimates in the absence of data on actual trades. On this matter it is important to be very clear – on any given day most, if not all, the quoted yields listed in Bloomberg and CBASpectrum do not reflect yields at which the bonds were traded. Rather they reflect yields at which somebody estimates that the bonds would have traded had there been willing buyers and sellers on that day.

2.3.2. No long-dated BBB+ bonds

23. It is not necessarily the case that two bonds with the same time to maturity and same credit rating will attract the same price and, in fact, one may often observe very different prices for such bonds (eg, if the market for those bonds have different levels of liquidity).

24. From the data published by Bloomberg and CBASpectrum, it is clear that there are no bonds that have attributes that make them directly comparable with a 10-year BBB+ rated bond. The longest dated bond with price information in either database is for the General Electric Corporation, at 9.86 years from 6 May 2009 (yield of 13.2% reported in CBASpectrum). However, this bond is rated AA+. The longest dated BBB+ rated bond is for Santos, for which pricing information is reported by both services (yield of 8.9% reported by CBASpectrum). This bond matures on 23 September 2015, giving it a time to maturity of 6.38 years from 6 May 2009.

25. Both the bonds described above are similar to the required 'benchmark' bond in one required attribute, but not the other. Clearly, if one were to choose the estimated General Electric bond yield as the proxy for the benchmark rate one would end up with

a much higher yield than if one chose the Santos yield (13.2% rather than 8.9%). As discussed later, there are good reasons to regard the GEC yield as an overestimate and the Santos yield as an underestimate of the benchmark rate.

26. This highlights a more general proposition that even if there were a bond that just happened to have exactly 10 years to maturity and be rated at BBB+, this does not mean that we can, or should, rely completely upon the yield reported for this bond to serve as the benchmark rate. Selecting the yield from a single bond, uncorroborated by other evidence, is not likely to give a result that is representative r average of all bonds.

27. Furthermore, using a single observation as the required 'benchmark' means that all the information embodied in all other bond prices is thrown away, under the implied assumption that this is not useful in explaining the yield on 10-year BBB+ rated bonds. As a general rule it is wasteful and inefficient to exclude data that may potentially assist to improve an estimate of a benchmark yield for 10-year BBB+ corporate debt.

28. The AER's methodology for estimating a 10-year yield on BBB+ corporate bonds using Bloomberg's fair value estimate provides an example of how this principle can be used in practice. Since Bloomberg no longer reports yields for BBB debt of 10-year maturity, rather than simply accepting the yield on 8-year BBB debt as the best estimate for this value the AER sought to improve on this estimate by using information about the relative yields on 8-year and 10-year A rated debt, as estimated by Bloomberg. In theory, this adjustment makes efficient use of the information that is available to achieve a better estimate for the yields on 10-year BBB+ rated corporate bonds.[17]

2.3.3. Low liquidity and high liquidity premium

29. In a financial crisis there is heightened uncertainty about the returns on both corporate debt and equity. As discussed below, this tends to create what is known as a 'flight from risk' or a 'flight to safety'. As a consequence, investors reduce their demand for illiquid products and increase their demand for liquid instruments, such as government bonds, increasing demand for these products. This is partly because of the uncertainty about when major investors are going to need quick access to cash to settle other obligations and partly because the heightened uncertainty about the value of corporate assets tends to make these markets less liquid. Moreover, the collapse of investment banks (and investment banking generally) has meant there are fewer players with less deep pockets willing to 'make the market' for a particular bond or stock by buying/selling it when they believe it is being mispriced.

[17] In practice, as I show in section 3, the Bloomberg estimates that the AER relies upon in calculating this revised estimate are not themselves founded upon actual data and hence each of the estimates that the AER relies upon are problematic.

30. All things being equal, this means that in general investors are likely to seek to sell out of corporate bonds, thus reducing the prices and increasing the yields. However, for the reasons described above, bonds that retain some liquidity will be less affected by this trend and will retain higher prices and lower yields than the majority of bonds, which have been left illiquid. That is, in the context of the current financial crisis, the premium for liquidity is considerably higher than it has been historically, and this effect will cause more liquid bonds to have materially lower yields than illiquid bonds.

31. Because there is little trading in corporate bonds at the moment, it is also the case that many bonds are traded infrequently. Methodologies that estimate a benchmark cost of debt that have reference to only the most liquid bond yields will be biased, to the extent that these bonds are not representative of their class and, as described above, may have lower yields than the average bond.

32. In a market where there are many bonds that are traded liquidly (and a minority that are not) this bias is not likely to be material. That is, as long as there is a relatively large pool of liquid bonds, particularly of the type that closely approximate the benchmark we require, this can give some confidence that the average yield over these bonds is a good approximation for the benchmark, relative to other methodologies that might use more information.

33. However, in the current market, there are only a few bonds that give rise to sufficient pricing information to be described as liquid and, even then, as explained earlier it is not necessarily the case that this pricing information is based on actual trading information. Since there are even fewer liquid bonds that are both BBB+ and long dated, methodologies that rely only upon the most liquid pricing information may, in effect, rely on a very small pool of bonds that are not representative generally of bonds at that maturity or in that credit class.

34. To the extent the that the concept of the *benchmark rate* is one that reflects the typical characteristics of a 10 year BBB+ bond then a consistent fair value estimate, in the current market conditions, would not be one that restricted itself to the most liquidly traded bonds.

2.4. Consistency with accepted finance theory

35. I describe above how the current market conditions for corporate bonds mean that there are few trades and that most prices are ‘indicative’. A further problem associated with making fair value estimates from a very small sample is that selection bias or simply random chance may give rise to fair value estimates that are inconsistent with accepted finance theory.

36. For example, if no restriction is placed on fair value curves for different credit ratings crossing then it is quite possible that the vagaries of the yields on particular bonds

within each credit rating may cause the fair value yields to cross if those fair value yields are solely fitted to the data in that credit rating. Clearly, this would be an undesirable theoretical property for fair value yields to have (eg, for a BBB 6 year fair value yield to be less than an A 6 year fair value yield). I understand that both Bloomberg and CBASpectrum impose constraints such that this never occurs (at least inspection of historical data suggests that this is the case).

37. A further restriction that one may wish to impose is that credit spreads (ie, differences between corporate bond and Commonwealth Government bond yields) change smoothly over time and that they tend to increase with maturity of a bond (at least for investment grade bonds). At attachment A to this report there is a note from Professor Grundy which concludes:

> ***Conclusion on the term structure of debt margins based on an implementation of the extant theoretical finance literature****: While a downward sloping term structure of debt margins beyond 6 years cannot be ruled out in a setting with an alternate stochastic process for changes in firm value, an extended Merton (1974) model incorporating coupon payments and bankruptcy costs implies a flat or upward sloping term structure of debt margins when the model is evaluated at realistic values for the asset volatility and recovery rate parameters.*

38. Professor Grundy also concludes that this theoretical property is consistent with empirical observations. Therefore, one may wish to use discretion to impose a constraint on the fair value estimates that captured this property of credit spreads – especially if there was a paucity of data in the relevant region of the term structure.

2.5. Specific criteria when selecting data sources

39. Consistent with the five general criteria listed above I incorporate into these criteria more detailed criteria reflecting the above observations. The methodology should, as far as is practical:

   i. reflect an unbiased estimate of the representative yield at the time of issue for ‘typical’ corporate bonds with a maturity of 10 years and a BBB+ long-term credit rating from Standard & Poor’s;

   ii. utilise a methodology that is not unnecessarily reliant on a single or small number of observations and/or individual views but efficiently uses the totality of information available, particularly where the available information is sparse;

   iii. gives rise to estimates that are consistent with standard predictions of finance theory and past empirical relationships;

   iv. give rise to estimates that are consistent with current market conditions and those estimates should change as market conditions change; and

v. be transparent including in relation to how discretion is applied. If that discretion results in yield estimates that are inconsistent with other potential proxies for the benchmark rate this inconsistency should be able to be explained in terms of why the alternative proxies are worse estimates for the benchmark rate.

40. There is also possibly a sixth criterion that would be desirable. This criterion does not flow from consideration of finance issues but more from consideration of process issues. Specifically, given that parties to regulatory proceedings may have vested interests in the outcome of the estimated benchmark corporate bond rate then ideally:

vi. the source of the estimate would be as independent as possible from interested parties to the regulatory proceedings.

3. Comparison of Bloomberg, AER and CBA Spectrum methodologies

41. Bloomberg and CBASpectrum are, to the best of my knowledge, the only data services that produce ‘fair value’ estimates for debt with a specific credit ratings and maturities for Australian corporate bonds. A ‘fair value’ estimate is an estimate of some form of ‘average’ or ‘representative’ yield for a bond of a specific credit rating and yield to maturity. In this sense an accurate or unbiased ‘fair value’ estimate can be equated with the concept of a ‘benchmark rate’.

42. This makes a close examination of both Bloomberg and CBASpectrum estimates particularly relevant in the context of this paper. It is also the case that Australian regulators have relied heavily on Bloomberg and CBASpectrum fair value estimates when setting the cost of debt for regulated businesses (including the AER’s current methodology which relies solely on Bloomberg fair value estimates).

43. In this section I compare the methodologies used by Bloomberg (and implicitly the AER) and CBASpectrum in arriving at fair value estimates. I then assess these against the criteria described in section 2. At the outset, I note that both Bloomberg and CBASpectrum estimate the fair value for trades of existing bonds on the secondary market. Other things constant, one would therefore expect both CBASpectrum and Bloomberg to have downward biased estimates of the benchmark rate which I interpret to be the interest rate on newly issued debt (see discussion in section 2.1 and criteria i at paragraph 39 above).

44. This view is supported by Bloomberg staff in a response to Victorian electricity distribution businesses who have asked whether a new domestic corporate BBB+ bond might be issued at a margin over the "BBB" fair market yield. Bloomberg advised that:

> *“I am afraid that this is a question better asked of a Debt Capital Markets Desk. Bearing in mind that the curves are representative of secondary market prices and trading sizes, new issues have nearly always been issued at a premium to this curve. My experience has been that the premium has increased during this period of market turbulence as both Buy and Sell side clients have demanded a greater risk premium.”*[18]

[18] *Debt Risk Premium for use in the Initial AMI WACC Period*, A paper jointly prepared by the Victorian Electricity Distribution Businesses, 1 June 2009.

45. An overall conclusion of the rest of this section is that methodology employed by both Bloomberg and CBASpectrum relies heavily on the discretion and judgement of each service. At any given time, it is possible to form an opinion about the accuracy of that discretion and judgment in the context of providing an estimate of the benchmark rate. However, precisely because it involves an exercise of judgement and discretion, it is not possible to compare this aspect of each service's methodology outside the context of a specific output from each service on a particular day.

3.1. Bloomberg methodology

3.1.1. Discretion used in estimating 'consensus' bond yields

46. Each day Bloomberg publishes a fair value corporate bond curve for each of the credit ratings AAA, AA, A and BBB. It also publishes the bonds and their estimated yields it had regard to when estimating that fair value curve. Bloomberg does not fully disclose how it determines which bonds are included and which bonds are excluded from the construction of the fair value curve. Rather, Bloomberg simply states in relation to the BBB fair value curve:[19]

> *"The curve is populated with Australian dollar denominated fixed-rate bonds issued by Australian companies. The bonds have ratings of BBB+, BBB, BBB- from S&P, Moody's Fitch and/or DBRS. The yield curve is built daily with bonds that have either Bloomberg Generic (BGN) prices, supplemental proprietary contributor prices or both. The bonds are subject to option-adjusted spread (OAS) analysis and the curve is adjusted to generate a best fit."*

47. It is not transparent what is meant by *supplemental proprietary contributor prices*. It would appear that Bloomberg's methodology allows for the possibility that it would use a specific pricing estimate (supplemental proprietary contributor prices) in preference to other pricing estimates or would rely solely on that specific pricing estimate when no other pricing estimates are available. However the source and nature of those estimates are not disclosed.

48. Similarly, the nature of the process for determining whether a bond has Bloomberg Generic Pricing (and what that Bloomberg Generic Price is) is determined using judgement and discretion exercised by Bloomberg. With respect to these prices Bloomberg states:[20]

> *"Bloomberg Generic Price (BGN) is Bloomberg's market consensus price for corporate and government bond.* [sic] *Bloomberg Generic Prices are calculated*

[19] This statement is made on the Bloomberg screen when it describes its bond prices.

[20] Sourced from Bloomberg terminal on 26 May 2009.

by using prices contributed to Bloomberg and any other information that we consider relevant. Bloomberg does not make a market in any of the securities that we price. The actual methodlogy we use is proprietary and depends on the type of pricing and the markets involved. The goal of the pricing is to produce "consensus" pricing. To the extent that we are not comfortable that a bond can be assigned a consensus price at any time, we will mark it "not priced". We constantly and vigorously review the performance of the system and alter it as we determine necessary to achieve our goal."

49. In summary, Bloomberg states that it uses discretion in arriving at what it considers are "consensus" bond yields and in determining whether a "consensus" bond yield exists.

3.1.2. Discretion used in excluding outliers

50. Finally, even for prices that have Bloomberg Generic Pricing (ie, which Bloomberg regards as reflecting 'consensus pricing') Bloomberg appears to exercise further discretion in excluding 'outliers' from this sample when building its fair value curves. [21] I am unaware of the criteria Bloomberg applies when determining that a bond constitutes an outlier.

51. I illustrate the exercise of this discretion below. Figure 1 below shows the Bloomberg fair value curve for BBB on 6 May 2009. Each dot in that figure represents the yield to maturity and the term to maturity of a particular bond for which there was pricing on Bloomberg on that day.[22] However, only the blue dots represent the bonds that Bloomberg used to determine the fair value curve. The orange crosses represent bonds that were excluded by Bloomberg from the generation of that curve.[23]

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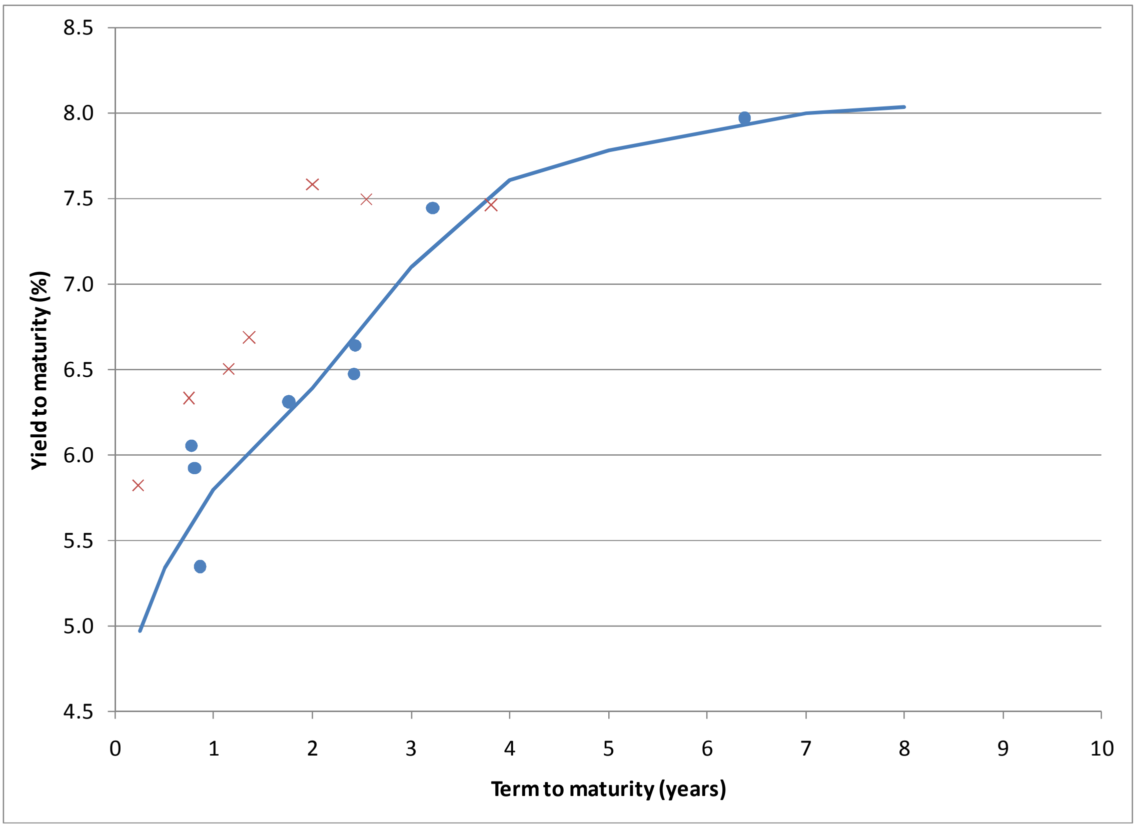
[21] See page 9 of a presentation by Michael Lee to the International Bond Market Conference 2007, Taipei. Available at http://taipeibond.gretai.org.tw/cv/Bloomberg%20Mr.%20Lee(panel%203-1).ppt.

[22] I have not shown two bonds that Bloomberg excludes from its BBB fair value estimation process on this graph. These two bonds each have yields of 18.6% (GPT) and 21.3% (Fairfax) and to show them would require a scale of the graph that would prevent closer examination of the area of interest around Bloomberg's BBB fair value curve.

[23] Appendix B provides screen shots from Bloomberg that describe which bonds were included and which were excluded. Only 9 out of 17 BBB bonds were included.

Figure 1: Bloomberg BBB fair value curve and included/excluded bonds on 6th May 2009

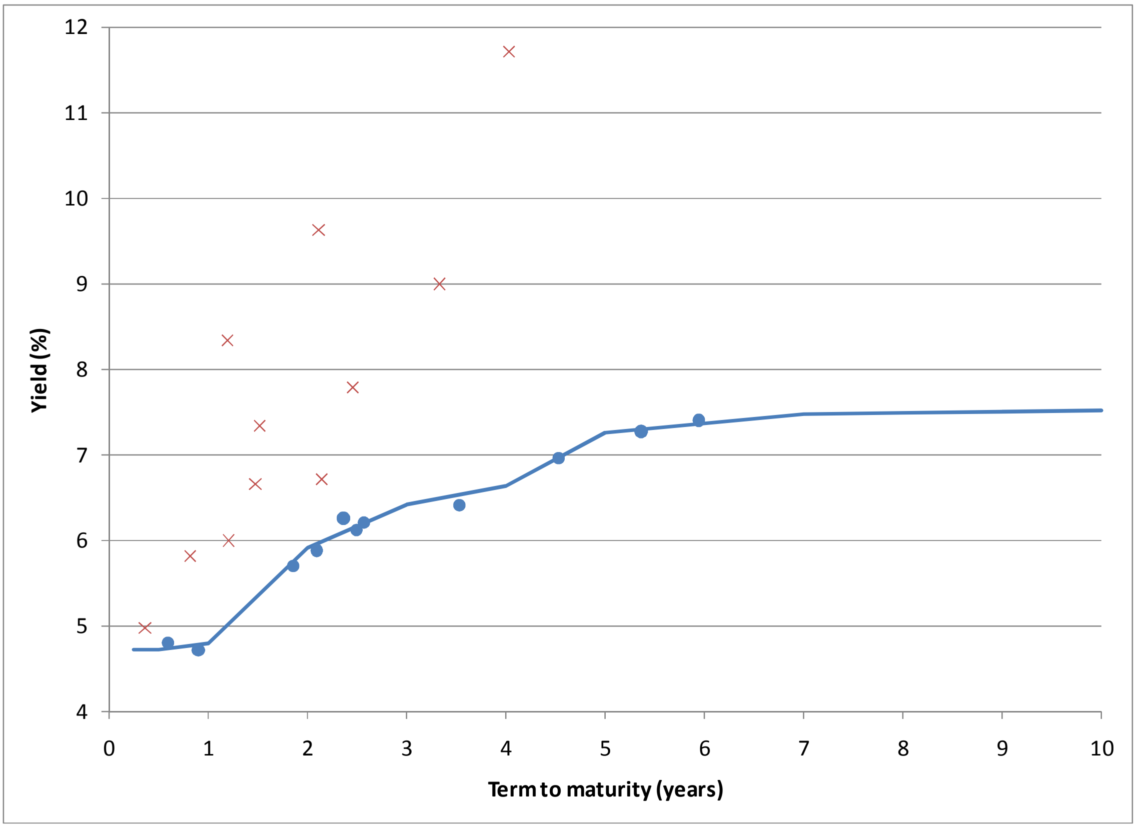


Source: Bloomberg

52. The above graph illustrates that seven bonds with pricing in the vicinity of the Bloomberg fair value curve have been excluded by Bloomberg. Of these, six have pricing that is above the Bloomberg fair value curve and one has pricing that is slightly below. It appears clear that the impact of including these bonds would have been to result in a higher fair value curve.

53. Given the AER also uses the Bloomberg A fair value curve to determine its estimate of the cost of debt, I provide a similarly formatted graph for Bloomberg's A fair value curve. I also supply the relevant data in tabular form in Appendix B to this report.

Figure 2: Bloomberg A fair value curve and included/excluded bonds on 6 May 2009



Source: Bloomberg

54. In this case all of the excluded bonds had higher yields. Had some or all of these bonds been included then it is reasonable to assume that the fair value curve for A would have been both higher and steeper than the actual fair value curve estimated by Bloomberg.

55. It is also relevant to note that Bloomberg's methodology may be such that it excludes illiquid bonds from its methodology. Specifically, a presentation by Bloomberg staff states:

> *"The availability of BGN price for a bond is an indication of good liquidity for that bond"*[24]

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24 See page 9 of a presentation by Michael Lee to the International Bond Market Conference 2007, Taipei. Available at http://taipeibond.gretai.org.tw/cv/Bloomberg%20Mr.%20Lee(panel%203-1).ppt . This presentation predates the global financial crisis and it is general in nature so we cannot know to what extent it reflects current practice.

56. In the current circumstances I consider that this would make the Bloomberg fair value curve a biased estimate of the 'average' or 'typical' cost of debt for BBB bonds. Bloomberg appears to only use bonds with Bloomberg Generic Pricing (BGN) to determine its fair value curve. However, the above quote implies that its BBB fair value curve is, in reality, a fair value curve for *liquid* BBB bonds. In ordinary circumstances where there is a relatively small liquidity premium then this may be less problematic. But in the current circumstance of a large number of illiquid corporate bonds, by focussing only on the most liquid bonds the Bloomberg methodology would give rise to a biased estimate of the true average cost of debt for bonds of any given credit rating.

3.1.3. Discretion used in fitting curves

57. Once Bloomberg has settled on a set of bonds used to generate its fair value curves Bloomberg uses further discretion to generate a 'best fit' to that data. The methodology employed by Bloomberg has been described in a 2005 NERA report which the AER has referenced as informing its understanding of the Bloomberg methodology in the context of its NSW electricity distribution decisions[25]. The NERA report (authored by the author of this report) describes the Bloomberg methodology as follows:

> *"For each credit rating, Bloomberg nominates a number of predetermined maturity points on the yield curve (3 and 6 months, 1, 2, 3 4, 5, 7, 8, 9, 10, 15, and 20 years – or fewer if there are limited long dated observations). Bloomberg then estimates the yields to maturity on the set of bonds that would both sell at par and have maturity dates exactly equal to the predetermined maturity points. The estimation procedure minimises the sum of squared deviations between actual observed yields and fair yields on bonds, assuming that the fair yields on bonds selling at par with maturity dates between two nominated maturity points are determined from a straight line joining the fair yields on the two immediately surrounding bonds with maturities equal to the predetermined maturity points.*
>
> *As such, there is no predetermined mathematical relationship (functional form) linking the values on the yield curve at each predetermined point."*

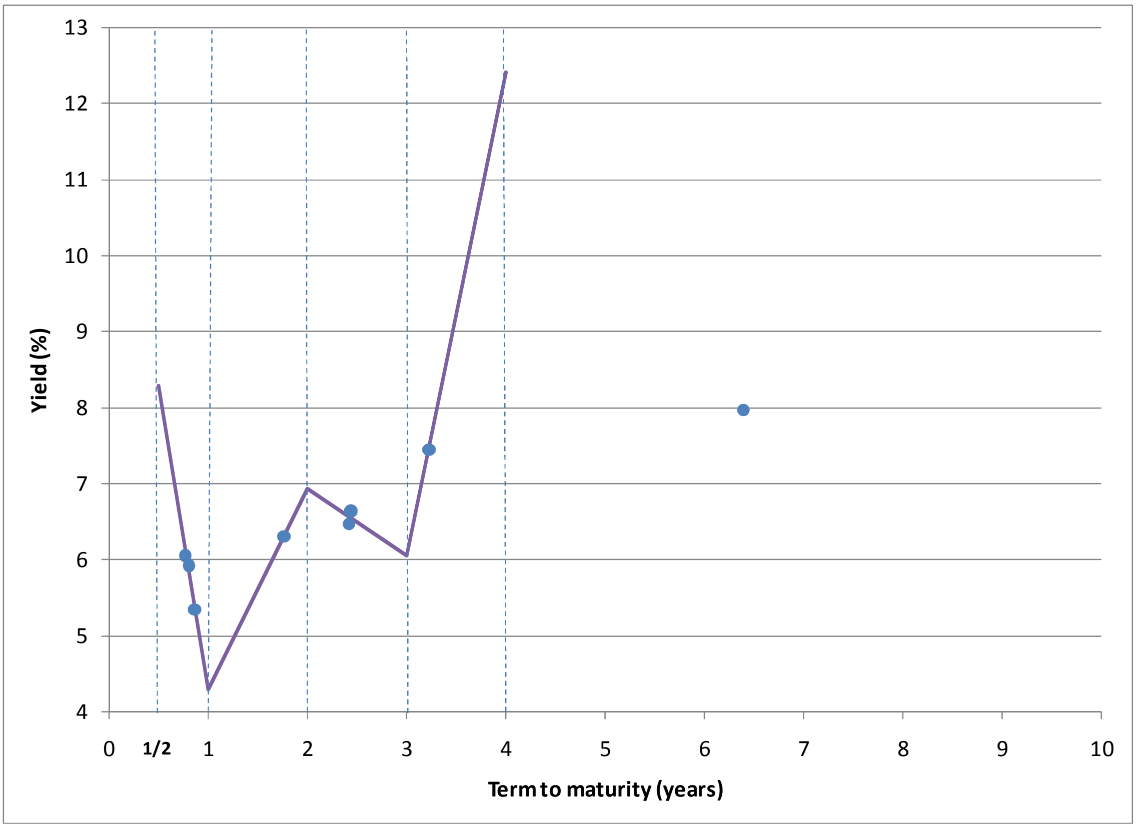
58. This methodology has an important potential advantage in that it does not specify a particular shape for the yield curve (mathematical functional form). Rather, it lets the available data determine the shape of the yield curve. For example, the shape of the yield curve could be upward sloping in some maturities and downward sloping in other maturities if that was what the data actually showed to be the case.

25 Page 230 of NSW distribution determination 28 April 2009 references: NERA, *Critique of available estimates of the credit spread of corporate bonds*, May 2005.

59. However, this potential strength of the above methodology is a weakness in situations where there are only a small number of bonds being used to estimate the yield curve. Specifically, the Bloomberg methodology described above will only give rise to a well defined yield curve when there are multiple bonds between each predetermined maturity point. When there are a limited number of bonds between each predetermined maturity date it will give a very poor estimate of the true yield curve for a *representative* bond of that credit rating. In the extreme, where there is one bond between each of the relevant maturity dates then the above methodology will be able to perfectly fit all the data points but will do so by taking on a highly unrealistic shape to the yield curve.

60. This is demonstrated in the below figure which shows the outcome of using this methodology on 6 May 2009 to derive the best fit between the bonds identified by Bloomberg as underlying its BBB fair value curve.

Figure 3: Fair value BBB curve based on 2005 NERA description of Bloomberg methodology using data from 6 May 2009



Source: NERA, Bloomberg, CEG analysis

61. The reason the fitted curve takes the above 'zig-zag' shape is that there are insufficient observations of bonds between any given predetermined maturities such that the best fit is given by extreme slopes between those predetermined maturities – with those extreme slopes going 'un-penalised' because they can simply be reversed to fit the next data point. The 6 May 2009 is described in Table 2 below.

Table 2: Bonds and yields underlying the Bloomberg BBB Fair value curve on 6 May 2009

	Years to maturity	Yield to maturity
Bank of Queensland	0.77	6.052
Snowy Hydro	0.81	5.924
Fosters Group	0.86	5.347
Dexus Property	1.76	6.309
Origin	2.42	6.473
Tabcorp	2.44	6.639
Wesfarmers	3.22	7.445
Santos	6.38	7.968

62. As Table 2 shows, the first three bonds in the Bloomberg sample have a maturity between 0.5 years and 1.0 years. Of these three bonds, the shortest maturity bond (Bank of Queensland) has the highest yield, the middle maturity bond (Snowy) has a lower yield and the longest maturity bond (Fosters) has a significantly lower yield still. Also, despite having significantly different yields the term to maturity for each bond are actually very close – all are within seven weeks of each other. As a consequence, the straight line that best fits the data between a predetermined maturity of a half year and the predetermined maturity of one year has a significantly negative slope (starting at a high yield of 8.3% at a maturity of one half of a year and ending at 4.3% at a maturity of one year).

63. Between one and two years to maturity there is only one bond (Dexus Property Group) which has a yield of 6.3%. Naturally, with only one point between one and two years it is possible to draw a line that directly passes through this point (which clearly minimises the sum of squared differences). As it happens this requires a steep upward slope between one and two years. To fit the next two points (Origin and Tabcorp) between two and three years (which are very close together) a downward slope is required. To fit the next point (Wesfarmers is only one bond with maturity between three and four years) it is necessary to impose a significantly upward sloping line (which can obviously fit the single data point between three and four years).

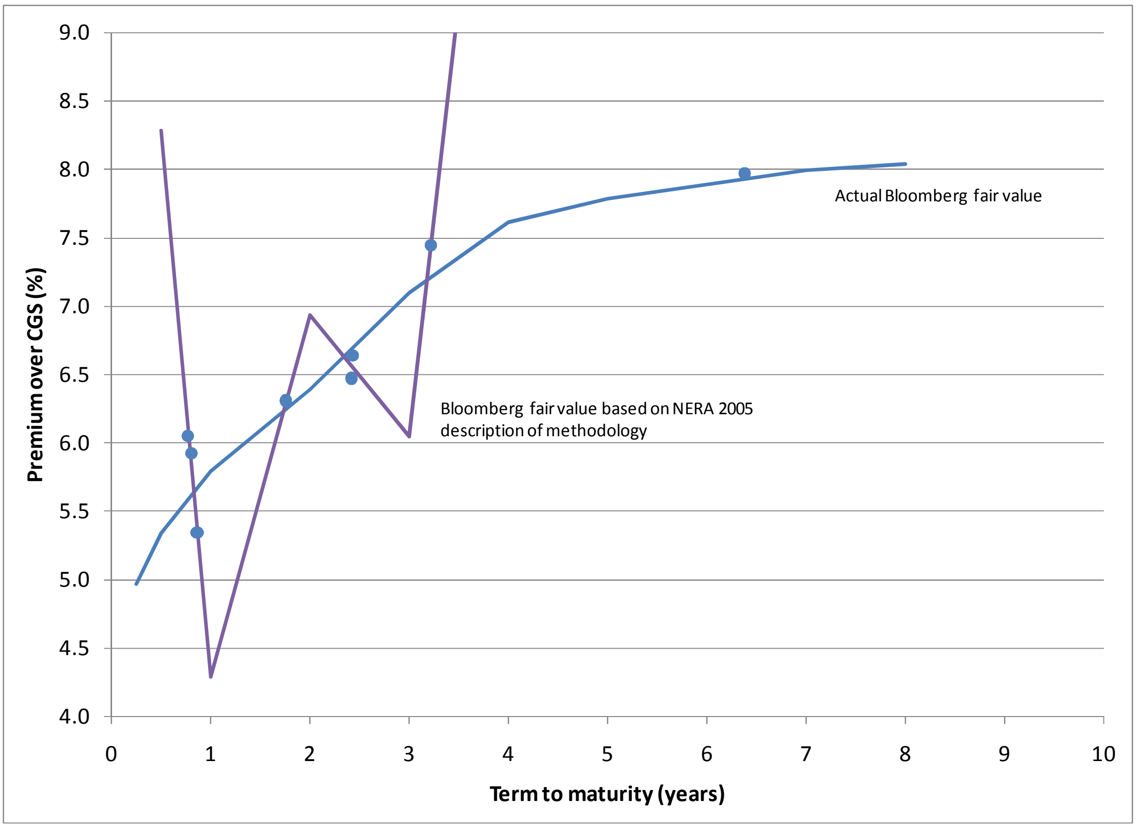
64. This is the unique set of straight lines between the Bloomberg predetermined maturities that best fits the underlying data points (ie, minimises the sum of squared

differences). The final data point (Santos at 6.38 years to maturity) could be fitted by an infinite number of straight lines. This point is the only data point with a maturity of more than 4.0 years. Given Bloomberg has predetermined maturity points at five and seven years one could draw any straight line between four and five years maturity and still be able to draw another straight line between five and seven years to exactly cross through the Santos observation.

65. As the above discussion demonstrates, application of the methodology described by NERA in 2005 results in an extremely unusual "fair value" curve – one that falls and rises dramatically at different maturity levels. This would not be the case if there were more bonds between each predetermined maturity level. The key point to note here is that when there are a limited number of bonds for which Bloomberg has prices the above methodology gives rise to shapes for the fair value curve that, despite fitting the data almost perfectly, are inconsistent with any theoretical prior beliefs about what the shape of BBB+ yield curve would be. I am unaware of any theoretical basis for expecting a yield curve to behave in the manner consistent with the application of the methodology described in the NERA report.

66. I assume that Bloomberg also finds the above outcomes undesirable as its fair value curves do not reflect the above shape. The difference between the actual Bloomberg fair value curve on 6 May 2009 and the above curve (derived according to the methodology described in the NERA 2005 report) is demonstrated in the below graph (the scale of this graph has been reduced to enable some further observations about the Bloomberg actual methodology on 6 May 2009)

Figure 4: Actual vs NERA Bloomberg BBB fair value on 6 May 2009



Source: Bloomberg, CEG analysis

67. Bloomberg can only achieve the more standard shape to its yield curve by imposing restrictions other than that the fair value curve simply be the best fit of the underlying data. In my view it is appropriate to impose restrictions that prevent the shape of the estimated fair value curve from being materially inconsistent with the properties predicted by both finance theory and/or empirical studies. This is especially true when there is a paucity of the underlying data. Clearly, the shape of the actual Bloomberg yield curve is a more credible description than the curve implied by a strict reading of the methodology reported by NERA of how yield to maturity changes with maturity for BBB rated bonds.

68. It is unclear what the further restrictions are that Bloomberg is imposing but a number of observations are possible:

- Bloomberg extends the curve beyond the points where it has data. In particular, the longest dated bond underlying the Bloomberg curve on 6 May 2009 was the Santos bond with 6.38 years to maturity. Yet Bloomberg reports fair value for both seven and eight years maturity – despite not having any BBB bond data to support a view on how fair value should move beyond seven years;

  - The same is true at the low maturity end. Bloomberg has no data points with maturity shorter than one half of a year but still reports a fair value at one quarter of a year maturity.

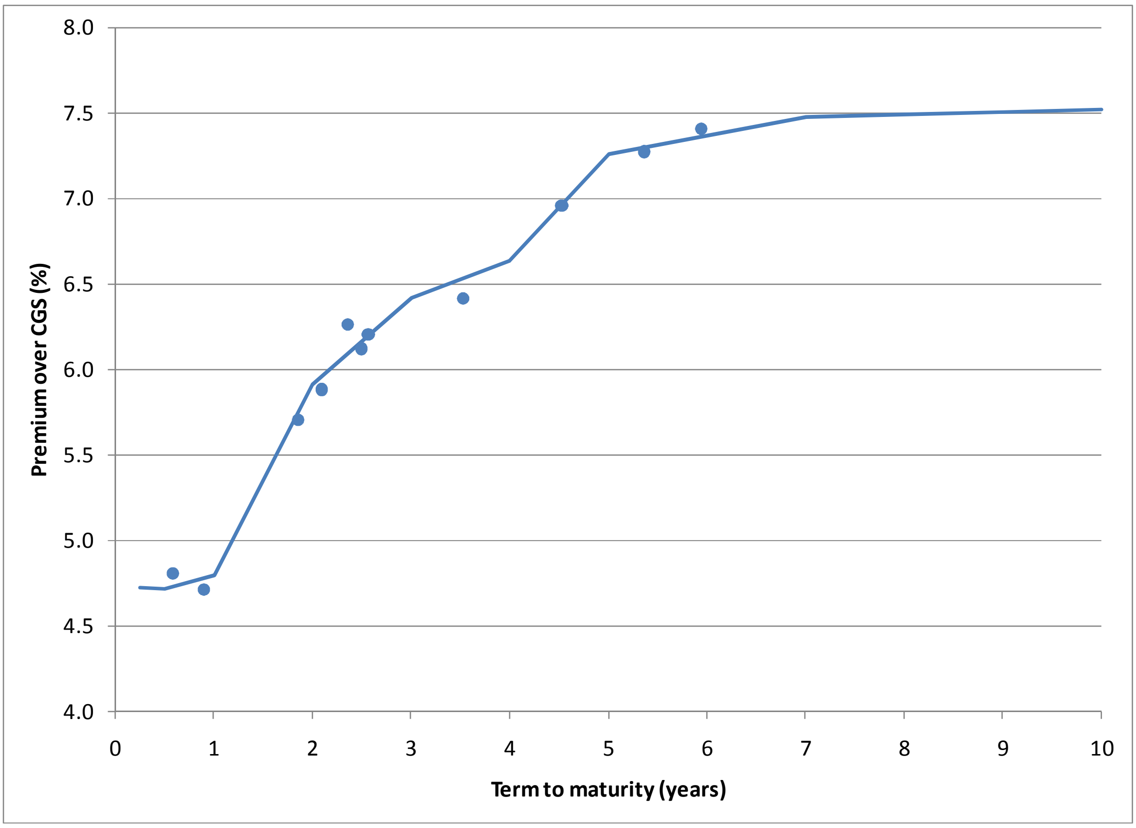
- Bloomberg uses its discretion to impose a nearly flat shape of the BBB fair value yield curve beyond seven years (as I shall discuss this is actually flatter than the CGS yield curve in that region – implying that credit risk falls with increases in maturity); and
- Bloomberg essentially fits the fair value curve at the long end to the single observation of the Santos data point (at 6.38 years to maturity).

69. The last dot point above is important as it suggests that, in the absence of other BBB+ bonds of similar maturity, Bloomberg's methodology is not sufficiently nuanced to enable it to distinguish between a 'typical' BBB+ fair value at that maturity and the Santos BBB+ bond yield.

70. Alternatively, it could be that Bloomberg has consciously decided that the Santos bond is 'typical' and it is only because of this conscious decision that it fits the fair value curve to this point. However, I do not find this a credible alternative explanation because Bloomberg's fair value curves always closely approximate any single observation used to build the curve. The only time Bloomberg's methodology does not do this is when there are multiple observations with similar maturity but different yields (ie, the only time that Bloomberg's fair value yields do not fit to the underlying data is when it is impossible to do so). It is clear that once a bond is included by Bloomberg in its sample to build the curve then it is treated 'as if' it is typical. It follows that a single observation will drive the shape of the curve unless there are other observations in the sample with a close maturity. Of course, this would not be problematic if there were a large number of bonds at all maturities. However, in the current circumstances it means that the estimated Santos bond yield entirely drives the Bloomberg BBB fair value estimate beyond 6 years.

71. It is also relevant to examine the Bloomberg estimation of the fair value for the A credit rating as this curve is also used by the AER to determine its estimate of BBB+ 10 year fair value. The following figure summarises the Bloomberg A rated fair value curve and the underlying data points Bloomberg reports that the curve is based on (ie, after removal of 'outliers').

Figure 5: Bloomberg A fair value on 6 May 2009



Source: Bloomberg

72. The same sort of observations can be made about the exercise of discretion in Bloomberg developing this curve. For example:

- Bloomberg extends the curve beyond the points where it has data. In particular, the longest dated bond underlying the Bloomberg curve on 6 May 2009 was a Telstra bond of 5.94 years to maturity. Yet Bloomberg reports fair value for both seven, eight, nine and ten years – despite not having any A rated bond data to support a view on how fair value should move beyond six years. The same is true at the low maturity end. Bloomberg has no data points with maturity shorter than one half of a year but still reports a fair value at one quarter of a year maturity.
- Bloomberg uses its discretion to impose a nearly flat shape of the A fair value yield curve beyond seven years.

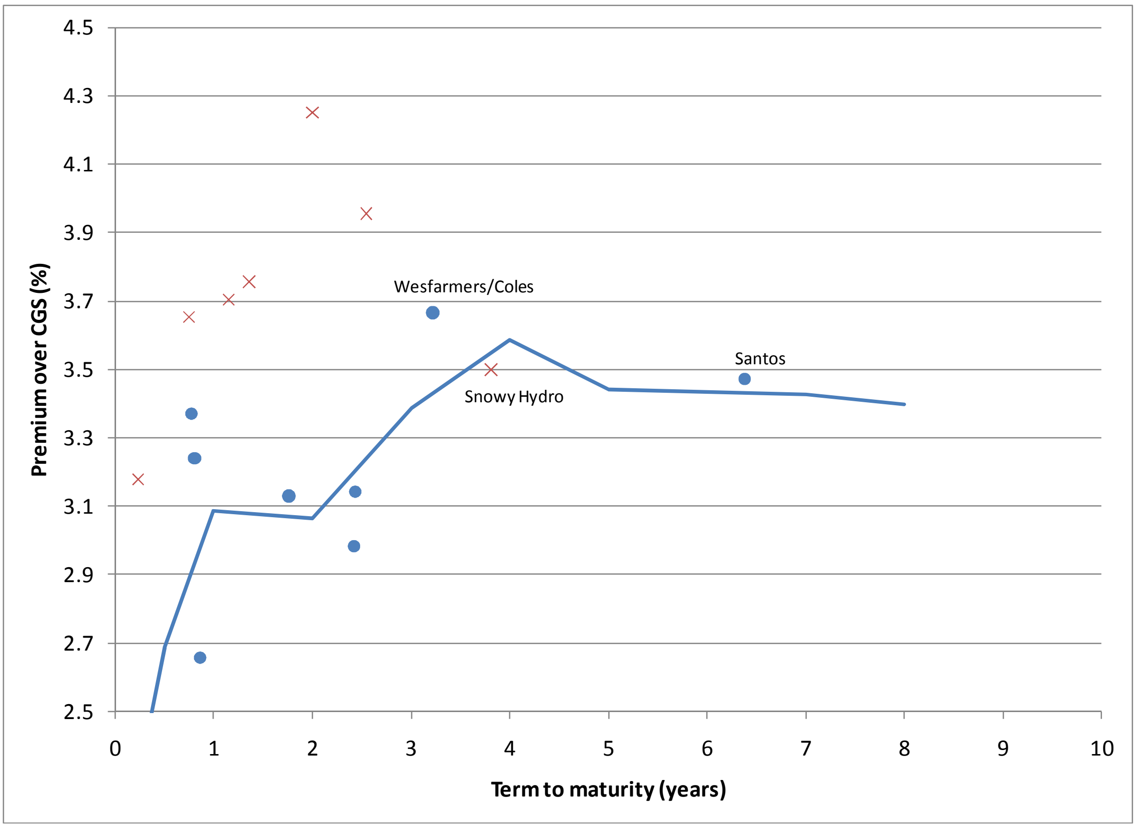
73. Bloomberg's current assumption of falling credit spreads is generally at odds with what one would expect both on a theoretical and historical empirical basis. When Bloomberg imposes a flat yield curve at long maturities it is actually imposing a flatter

yield curve than the underlying CGS yield curve. Consequently, Bloomberg is actually imposing an assumption that the spread to CGS falls as the maturity of a bond increases. As is discussed by Professor Grundy in attachment A to this report, this is generally at odds with what one would expect both on a theoretical and historical empirical basis:

> ***Conclusion on the term structure of debt margins based on an implementation of the extant theoretical finance literature****: While a downward sloping term structure of debt margins beyond 6 years cannot be ruled out in a setting with an alternate stochastic process for changes in firm value, an extended Merton (1974) model incorporating coupon payments and bankruptcy costs implies a flat or upward sloping term structure of debt margins when the model is evaluated at realistic values for the asset volatility and recovery rate parameters.*

74. The declining spread to CGS implicit in the Bloomberg long term fair value curves is illustrated in the below figures (which have the same coding for bonds used to build the fair value curve and bonds not used to build that curve).

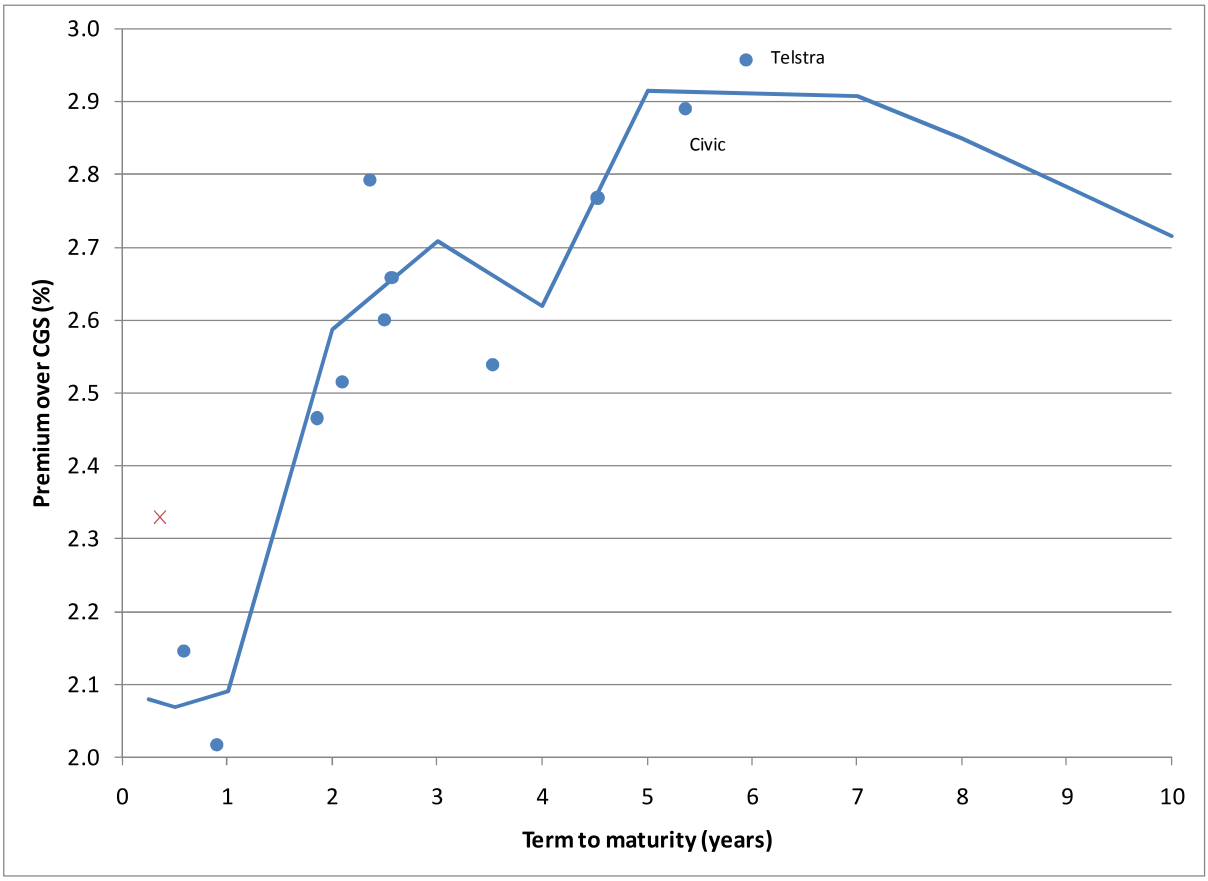
Figure 6: Bloomberg BBB fair value spread to CGS on 6 May 2009



Source: Bloomberg

75. As can be seen Bloomberg's fair value BBB curve is associated with a relatively steep increase in implied credit risk (spread to CGS) where Bloomberg has the most data (ie, zero to four years). However, beyond four years, Bloomberg imposes a reduction in credit spreads as maturity increases. This appears to be purely driven by an attempt to fit the fair value curve to the Santos observation at 6.38 years to maturity. However, even between 7 and 8 years where Bloomberg has no data it still imposes a declining spread to CGS as maturity increases.

Figure 7: Bloomberg A fair value spread to CGS on 6 May 2009



Source: Bloomberg

76. Once more, Bloomberg's fair value A curve is associated with a relatively steep increase in implied credit risk (spread to CGS) where Bloomberg has the most data (ie, zero to six years). However, beyond six years, Bloomberg imposes a reduction in credit spreads as maturity increases. This is most steep between 7 and 10 years despite Bloomberg having no data between 7 and 10 years.

Summary of conclusions

i) Bloomberg uses discretion and a proprietary approach in arriving at its pricing for individual bonds. The effect of the exercise of this discretion on its estimated pricing for individual bonds is unknown;

ii) Bloomberg appears to limit the construction of its fair value curves to rely solely on information contained in bond prices within that credit rating. This can be advantageous where that bond pricing data is plentiful. However, in the current market circumstances when bond pricing data is scarce it can be problematic.

iii) Bloomberg uses discretion in determining which of these bonds it will use to determine the fair value curves. The basis for this discretion in unknown. The effect of this discretion in the current environment appears to be to reduce estimated fair value curves.

iv) To the extent that this reflects a Bloomberg policy of estimating fair value curves for liquid corporate bonds then it is likely to make the Bloomberg fair value curves an inappropriate proxy for the benchmark rate in a market where most corporate bonds are illiquid.

v) Bloomberg uses discretion in the construction of the fair value curves (both within periods it has data and beyond the periods for which it has data). The effect of this discretion is to reduce the estimated fair value spread to CGS for long dated bonds. It is unclear what basis Bloomberg might have for assuming that this is appropriate.

3.2. AER method based on Bloomberg estimates

77. The AER's most recent methodology[26] is such that it estimates the yield to maturity for a 10 year BBB+ bond equal to:

AER 10 year BBB+ yield = Bloomberg 8 year BBB fair value + Bloomberg 10 year A fair value - Bloomberg 8 year A fair value

[26] See for example the 2009 NSW Electricity Distribution Final Decision.

78. Consequently, the accuracy of the AER methodology depends entirely on:

- The accuracy of the Bloomberg 8 year BBB fair value estimate as a proxy for the 8 year BBB+ benchmark rate;
- The accuracy of the Bloomberg A fair value curve between 8 and 10 years as a proxy for the shape of the benchmark BBB+ yield curve.

79. However, given the nature of Bloomberg's methodology this is equivalent to simply:

- adopting the Santos yield to maturity as the benchmark 6.38 years BBB+ yield to maturity;[27] and
- then applying a trivial increase in yield to maturity (of only 10bp or so) to arrive at an estimate of the benchmark 10 years BBB+ yield to maturity.[28]

80. The trivial increase in estimated yield from 6.38 to 10 years is a function of the Bloomberg assumption that the BBB and A fair value curves are flat in the region where Bloomberg has no data – and are flatter than the CGS yield curve. Consequently, the AER methodology arrives at an estimate of the debt risk premium that is less than the DRP on the Santos bond. This is illustrated in the below table.

Table 3: AER method compared to Santos bond on 6 May 2009

	Yield (%)	Spread to CGS (%)
Santos	7.97	3.47
AER BBB+ 10 year	8.07	3.26
Difference	0.10	-0.21

81. This is not a result that is peculiar to the 6 of May 2009. Bloomberg appears to consistently adopt the assumption that the yield curve is flat beyond the maturity for which it has data. Given that the Santos bond is the longest dated bond in its data base (for any credit rating) and provided that Bloomberg always fits its fair value curve to the Santos bond then it follows that the AER's method will always result in an estimate of 10 year BBB+ fair value that is only marginally above the Bloomberg estimate for the Santos bond. I note that from the 20th of March to the 20th of May the AER method always resulted in a BBB+ 10 year estimate of DRP that was less than

27 See Figure 1 above and note, in the absence of any other BBB data points in that vicinity, that the Bloomberg BBB fair value curve at 6.38 years to maturity is driven by the Santos observation.

28 See Figure 1 and Figure 2 and note that Bloomberg imposes the assumption of a flat yield curve beyond the points for which it has data in both the BBB and A fair value curves.

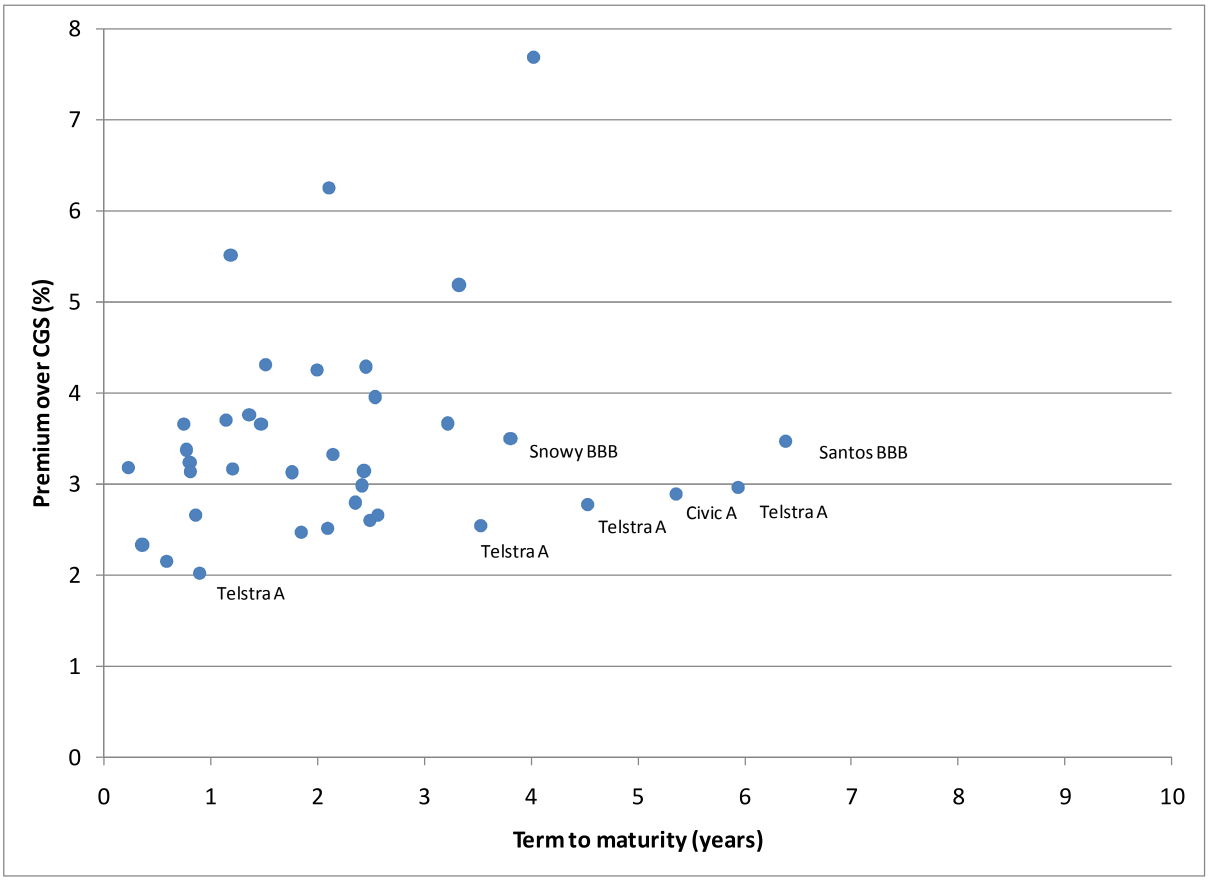
the Bloomberg estimate of spread to CGS for Santos and that this averaged at 0.22bp – suggesting the analysis of the 6 May was typical of other days during this period.

82. The AER's methodology effectively makes the following assumptions:

- that the Bloomberg estimate for the yield on the 6.38 year Santos bond is essentially the BBB+ benchmark rate at that 6.38 year maturity; and
- that Bloomberg is correct in imposing an assumption (with no apparent basis in the data) that the spread to CGS falls as maturity increases from 6.38 years to 10 years.

83. To illustrate why I regard these assumptions as problematic consider the following figure that reports the spread to CGS on all bonds in the Bloomberg data base that had a credit rating of BBB to A on 6 May 2009.

Figure 8: All Bloomberg yields for bonds rated BBB and A on 6 May 2009



84. Notably, the relatively low yielding bonds with longer maturities are all A rated and are mostly issued by Telstra. Also notably the credit spread curve for the Telstra bonds is steadily upward sloping at approximately the same rate. This provides a good indication that when one holds factors other than the credit rating constant one observes an upward sloping credit spread curve.

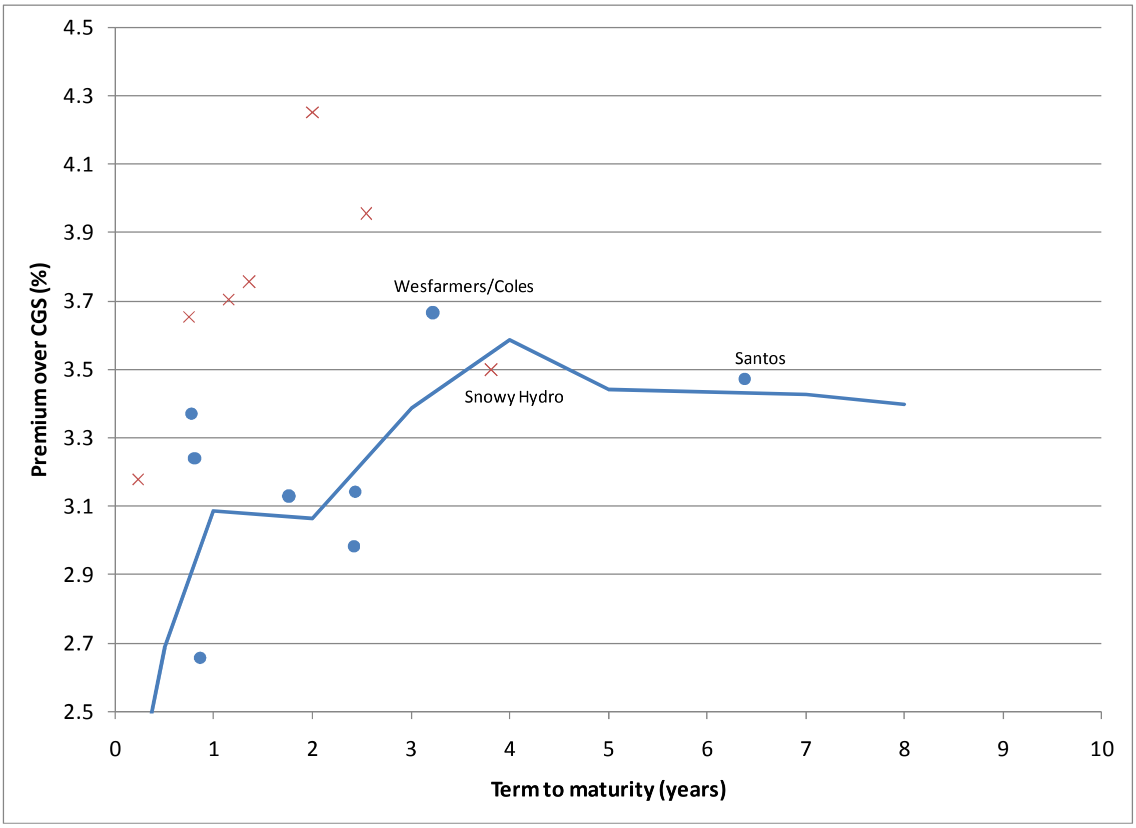
85. Given that the Santos bond is in the low end of the credit rating range BBB to A and given that it has the longest maturity of any bond then one would expect that it would have the highest spread to CGS. However, it has a relatively low spread to CGS being approximately the same as the mean spread to CGS in this sample (3.47% vs 3.48%)[29] and with 40% of observations having a higher estimated spread to CGS. This is despite the sample having on average a yield to maturity only 2.3 years, just

29 The average for the same has been calculated excluding the GPT and Fairfax outliers and include only those bonds shown on the chart.

over a third of the maturity of the Santos bond, and an average credit rating above the Santos bond. Given that there are so many higher rated bonds with a shorter time to maturity but a higher spread to CGS this is reason to be concerned that the Santos bond is not a 'typical' BBB+ rated bond.

86. This is also consistent with the fact that the Bloomberg BBB+ fair value spread to CGS curve needs to behave in a discontinuous fashion in order to fit the Santos observation as is described in Figure 6 above and reproduced for convenience here.

Reproduction of Figure 6: Bloomberg BBB fair value spread to CGS on 6 May 2009



Source: Bloomberg

87. As can be seen, after rising steeply to fit the other BBB+ bond observations the Bloomberg fair value curve suddenly drops and then 'flat lines' in order to meet the lone Santos observation at 6.38 years to maturity. A more continuous shape to the credit term structure would lead to the fair value estimate passing above the Santos observation. The discontinuous shape to a credit term structure appears to be driven by a paucity of data at the long end and the lack of nuance in the Bloomberg methodology that would allow it to pass materially above the Santos observation

(despite it being the only observation in the region). That is, the Bloomberg methodology does not appear to allow for the shape of the term structure at lower maturities (where there is more data) to influence the shape of the term structure at longer maturities (where there is only one data point). The fact that fitting the Santos observation requires this sort of discontinuity in the fair value spread to CGS suggests that the Santos bond is in some important characteristics different to the bonds used to determine the earlier part of the curve.

88. In order to illustrate the idiosyncratic characteristics of individual bonds that can affect their required yield it is useful to quote from a Commonwealth Bank of Australia 11 May Credit Strategy research note summarising relevant considerations for debt investors in Santos (note that this is written in a perfunctory style typical of analyst summaries):

> *Policy not to hedge FX or commodity risks is hurting prospective oil earnings but the credit profile changed materially upon receipt of $USD2bn from Petronas for GLNG deal in July 2008. Has subsequently spent $300m on a share buyback but at 31 December cash stood at $1.5bn and net debt at $1.2bn. Nevertheless lower oil earnings add to the uncertainty about how Santos will fund its 60% share of the USD$7bn+ GLNG capex in the 2010-2014 period (FID in H1 CY10), albeit we think the project represents a strong incentive to retain IG ratings. Following abolition state based limits on individual shareholdings, takeover speculation has soared with interest driven in part by its substantial gas reserves and resources (management moving to commercialise by moving downstream into generation). Government sanctioned divestment of interest in Indonesian 'mud-flow' project in December has reduced contingent liabilities and therefore uncertainty for prospective bidders (albeit third party claims are still possible). The range of potential domestic acquirers might be limited by regulatory (competition) issues but the likes of Woodside (A-) and BHP (A+) offer rating upside. Interest from offshore parties is likely to be extensive and could include some of the group's existing JV partners but any bid from a foreign company may face approval resistance at the Federal Government level. With CY08 result management outlined a range of possibilities for the FUELS hybrid and indicated it might elect to implement a combination of redemption, conversion and allowing the coupon to step up. CY09 Production guidance of 53-56mboe implies 2P reserves of 1,013mboe represents ~18.6 years of supply. Production likely to remain flat until CY14, when LNG projects are due to come on line.*

89. It is relevant to note that with net debt at $1.2bn and an average market capitalisation in May 2009 of around $12bn Santos' gearing as a proportion of total assets is less than 10%. Other things equal this would ordinarily be associated with a higher than BBB+ credit rating. However, as noted, Santos has a large capex program of around

4.2bn upcoming and, if funded with debt, will tend to increase gearing into the future.[30] Of course, as is the case with any specific company, there are a range of other considerations that are relevant to debt holders in that company (such as the prospect of takeover by specific other entities and those entities credit ratings). In my view it is not reasonable to presume that the yield on the debt of any one BBB+ rated company, such as Santos, is equal to the benchmark rate.

Summary of conclusions

The AER's methodology, in combination with Bloomberg's methodology, has the effect of setting the 10 year BBB+ benchmark rate almost exactly equal to the Bloomberg estimate of the yield on the Santos 6.38 year bond. The effect of this is that the AER methodology adopts the yield on a single bond (the Santos bond) as the benchmark yield. Given an upward sloping yield curve for CGS between 6.38 and 10 years this has the effect of setting the debt risk premium at less than the Bloomberg estimate of the spread to CGS for the Santos bond. In my view this is inappropriate as there is no reason to presume the Santos bond yield is representative of a benchmark BBB+ bond yield and there is evidence to suggest it is not (given its very low gearing and its low yield relative to other BBB and A rated bonds).

3.3. CBASpectrum methodology

90. I have had access to the detailed credit rating equations used by CBASpectrum in the past. Professor Bruce Grundy and I have described those equations in our 2005 paper for NERA referenced earlier in relation to the Bloomberg methodology.[31] In that paper we were critical of certain aspects of those equations which we regarded as resulting in a downward bias to long term and low rated fair value estimates. Since then, I understand that CBASpectrum has amended its methodology to remove the bias. For example, the Essential Services Commission of Victoria[32] states:

> *Since the release of the NERA paper, CBASpectrum has reviewed its methodology. The new approach as applied is summarised in a Commonwealth Bank Credit Research note. The note emphasised the proprietary nature of the models used to estimate fair value curves, which it deemed to be superior to competitors:*

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30 Although, even if this was entirely debt funded and added nothing to the market capitalisation of Santos total gearing would only rise to around 30% of total assets.

31 NERA, *Critique of available estimates of the credit spread of corporate bonds*, May 2005, page15.

32 ESCV 2008-2012 Gas Access Arrangement Review, Draft Decision.

Unlike commercial data providers, our fair-value indices are not simply interpolated estimates from a given rating category. Instead, CBASpectrum's curves are derived from a system of credit rating equations. This methodology allows for more efficient estimates, especially given relatively sparse data on lower-rated corporate bonds.

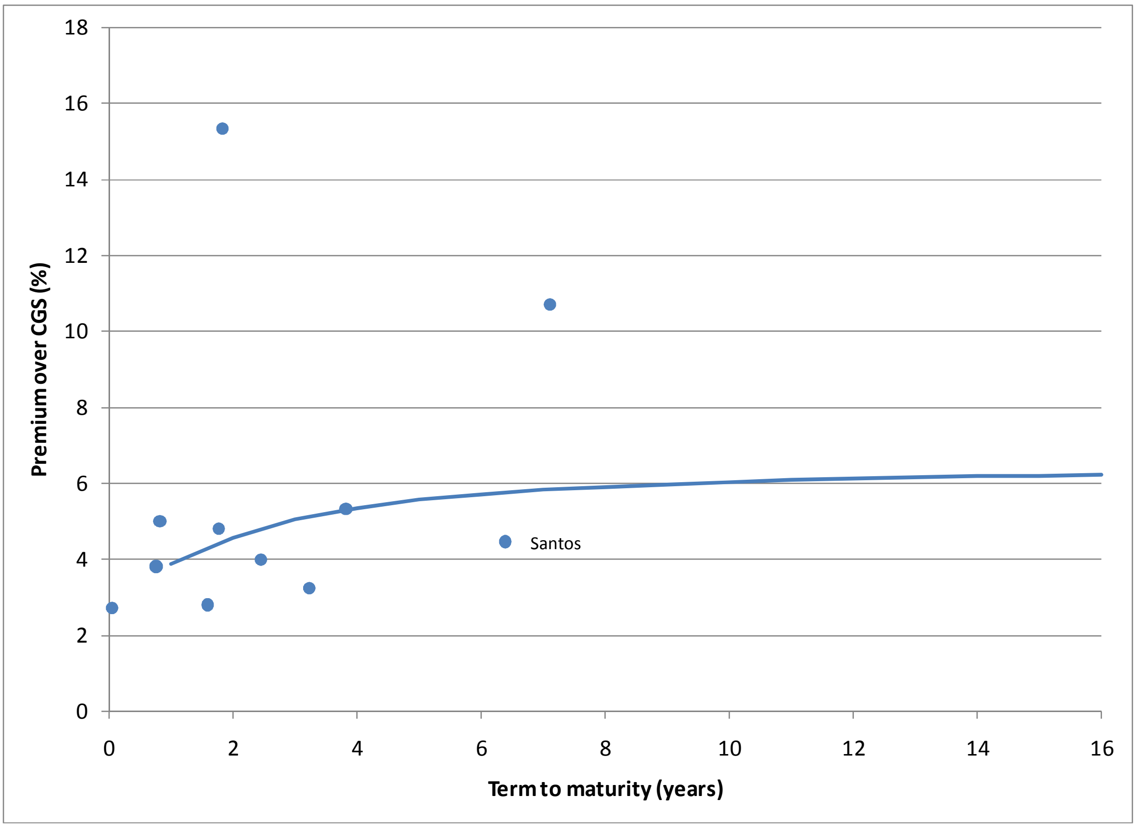
91. In its final decision the ESC adopted a debt premium that was equal to the CBASpectrum estimate.

92. Notwithstanding the changes to CBASpectrum's equations it is clear from my inspection of the fair value curves currently reported by CBASpectrum that it continues to impose a broadly similar functional form on the data as was the case in 2005. I note that the source of the bias identified in the NERA report was not the functional form but rather the optimisation process for fitting that functional form to the data.

93. Nonetheless, as noted in the NERA 2005 report, in a data rich environment a potential weakness of the CBASpectrum methodology may be that the pre-conceived functional form is not sufficiently flexible to represent the actual shape of the yield curve suggested by the data. On the other hand, this can be an advantage if these restrictions preserve characteristics of the fair value curve that are consistent with finance theory in the face of a paucity of available data.

94. Figure 9 below illustrates the curve for BBB+ bonds fitted by CBASpectrum relative to all of the BBB+ bonds in its data base on 6 May 2009.

Figure 9: Fair value BBB+ curves estimated by CBASpectrum on 6 May 2009



95. This figure demonstrates that, for BBB+ bonds in its database, CBASpectrum's BBB+ fair value curve provides a reasonable fit – underestimating the yield on some bonds and overestimating the yield on other bonds. It also demonstrates an important difference between the Bloomberg and CBASpectrum methodology is that the CBASpectrum methodology does not require its fair value estimate for BBB+ to cross through the Santos observation. That is, the CBASpectrum BBB+ fair value estimate passes above rather than through the Santos observation at 6.38 years to maturity.

96. It is worth noting that CBASpectrum's methodology arrives at this conclusion by simultaneously solving for the set of fair value curves that best fit all of the data used in its regressions – not just the BBB+ data. This means that the BBB+ curve will be informed by data for BBB+ bonds as well as data for bonds of other credit ratings. This is an attractive property of the methodology in the current circumstances where there is a relative paucity of data. For example, imagine a scenario where there were only one BBB+ bond and 10 A rated bonds. With only one BBB+ observation it is impossible to draw a curve for that credit rating having regard only to that observation. However, the 10 observations for the A rated bonds can be used to infer a shape for

both the A and BBB+ rated curve which does allow a curve to be drawn for the BBB+ rating.

97. The fact that CBASpectrum determines that the Santos bond is not typical of a BBB+ bond is consistent with the discussion at paragraph 84 and 85 above which similarly concluded that there was evidence to suggest that the Santos bond did not have a yield that is typical of a BBB+ bond with its maturity.

98. In 2008, the Essential Services Commission of Victoria concluded that it would be inappropriate to place a high weight on the Santos bond yield estimate for the same reasons identified in this report, namely, that one can not presume that its yield is representative of the typical BBB+ bond (although interestingly at the time the Santos bond yield was higher than the CBASpectrum fair value yield).

> *While Santos has the longest term to maturity of any bond in the sample, the fact that it is only one estimated value with no effective comparison (i.e. no equivalent bond of similar maturity to compare with), and as the methodology applied by Envestra to derive the ten year maturity adjustment is unknown, there are no grounds for weighting the Santos estimate to the extent advocated. Furthermore, the Santos corporate bond may be a special case in terms of its high yield with respect to its tenor, due to Santos facing greater cash flow volatility when compared to other BBB+ rated bonds.*[33]

99. I agree with the sentiments of ESCV that just because the only BBB+ bond with a long maturity has a particular yield does not mean that one can assume that the bond is representative of the typical or benchmark BBB+ bond with that yield. At the time the Santos bond had a relatively high yield and the ESCV rejected giving it undue weight. Currently the Santos bond has a relatively low yield and the same logic applies. The logic applies more so in the current context as there is evidence that the Santos bond currently *is* a special case (not just that it *may* be a special case as was posited by the ESCV).

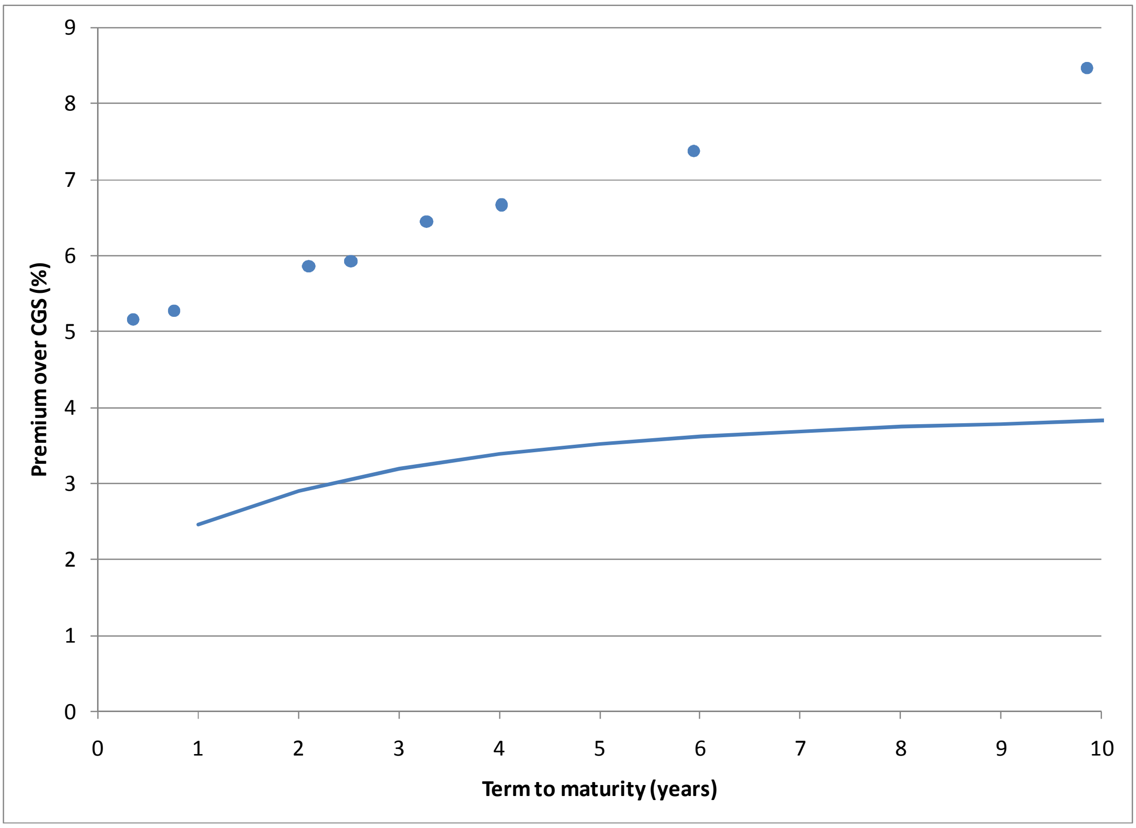
100. The imposition of the upward sloped credit spread term premia also suggests that CBASpectrum has formed a judgment that finance theory and/or past empirical studies justify such a shape – a view that is consistent with the views expressed by Professor Grundy in the attachment to this paper and is also consistent with the observation of the Telstra credit spread term premia discussed above.

101. Similarly, as demonstrated in Figure 10 below, the CBASpectrum fair value estimate for AA+ lies wholly below the observations for AA+ bonds in its database. That is, CBASpectrum uses information from other bond yields to conclude the typical AA+

33 Page 487 of the 2008 ESCV 2008-2012 Gas Access Arrangement Review, Final Decision.

bond would trade at a lower yield than the estimated yield on a small sample of AA+ bonds in its database (which all happen to be associated with a single issuer being GEC).

Figure 10: Fair value AA+ curves estimated by CBASpectrum on 6 May 2009



102. I do not have an in-depth understanding of the current proprietary methodology that CBASpectrum uses to estimate its fair value curves (just as I do not have an in depth knowledge of Bloomberg's proprietary method). However, it is possible to conclude on the basis of its estimates and the data underling them that CBASpectrum also applies judgement in using and interpreting the data available to it. In particular, I can clearly see that CBASpectrum:

a. Does not allow the very highest yielding bonds to drive its fair value estimates for any given credit rating (as per Figure 10 above);

b. predetermines a functional form that the fair value curves must fit, and this functional form:

i. assumes increasing and diverging yield curves that asymptotically become parallel; and

ii. assumes that fair value spreads to CGS are increasing with maturity.

c. uses bond information from all credit ratings to determine the level and relativities of the various fair value yield curves; and

d. extends forward its fair value estimate out beyond the longest dated bonds in its database.

103. Items b and c together from the above imply that CBASpectrum's fair value estimates for any particular credit rating may not necessarily closely track the data available from bonds at that credit rating, because the shape and level of the yield curve also relies on yields on bonds at other credit ratings. In the case of the AA+ bonds described above CBASpectrum's estimation technique clearly identifies these bonds as 'outliers' and sets its AA+ fair value estimate at materially less than this.

104. An important potential advantage of this methodology is that it can allow CBASpectrum to use more of the information available to it in order to fit fair value curves over all credit ratings. The accompanying limitation is that, while the method is powerful in its application and allows CBASpectrum to estimate yield curves for each credit rating between BBB and AAA, it depends on the appropriateness of its assumed functional forms for its yield curves.

105. I note at 102.d above that CBASpectrum must be exercising some degree of discretion in estimating fair value curves out to 16 years maturity, whereas the data that it relies upon contain bonds of maturity no greater than 10 years. CBASpectrum is either constructing the shape of the yield curve at this point based on exogenous assumptions or it is assuming that it can extend forward the curves it has estimated between 1 and 10 years.

106. I also note that on some dates there are significant changes in CBASpectrum estimates of fair value yields that are transient in that they are immediately reversed - with fair value yields falling/rising back to the levels previously estimated within one or two days. The fact that CBASpectrum reverses these changes suggests that they should be regarded as aberrant. I do not know what causes these aberrant estimates. I recommend that, should they occur in a particular measurement period, then they should be excluded from any estimate of the average CBASpectrum estimate of fair value over that period.

107. Whether published by CBASpectrum or Bloomberg, a reasonable practical filter would be to define an observation as aberrant if that observation is more than 5% different from the average of both the preceding and following five days of non-aberrant observations.[34] Applying this rule would have excluded eight CBASpectrum

34 Implementation of this filter requires that the observations in the ten surrounding days (the days used to test whether the observation in question is aberrant) are an appropriate benchmark from which to test for aberrance. This requires that any potentially aberrant days are excluded from the average of the five preceding/following days – otherwise 'false positives'

observations over the period 1 January 2008 to 22 June 2009.[35] However, four of those days occurred in a 19 day period from 20 May 2009 and 15 June 2009.

Summary of conclusions

i) CBASpectrum uses discretion and a proprietary approach in arriving at its pricing for individual bonds. The effect of the exercise of this discretion on its estimated pricing for individual bonds is unknown;

ii) CBASpectrum appears to use information from all of its bond pricing data to determine shapes and levels for all of its fair value curves. This may be a significant advantage of the CBASpectrum methodology in the current circumstances with limited bond pricing data.

iii) CBASpectrum uses discretion and a proprietary approach in determining fair value curves from its individual bond data. In doing so it exercises its discretion.

iv) CBASpectrum uses discretion in the construction of the fair value curves beyond the periods for which it has material data available. The effect of this discretion is to impose a slight increase in spreads to CGS for longer dated bonds. This assumption has support in the theoretical/empirical finance literature.

3.4. Comparison

108. It is important to note at the outset that in 'normal' market conditions the differences between CBASpectrum fair value estimates and AER fair value estimates (based on Bloomberg fair value estimates) have been relatively small. It is only since the advent of the global financial crisis and, in particular, the collapse of Lehman Brothers in September 2008 that the differences have become large.

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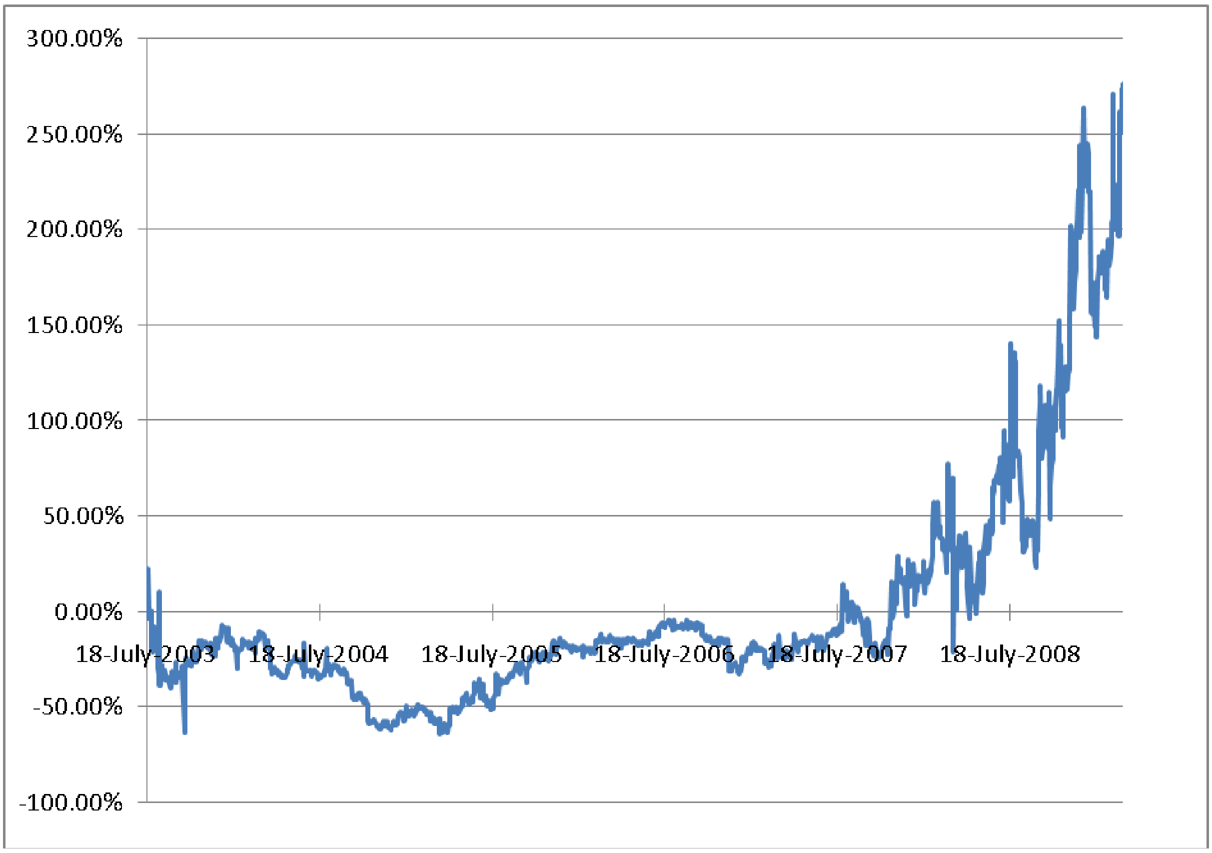
will result with some observations being found to be aberrant only because the benchmark period is distorted by the existence of an aberrant observation. One way to remedy this problem is by identifying any potentially aberrant observations, including false positives, on the first pass of the test (ie, where no data is excluded). The test can then be rerun excluding all of these observations from the calculation of the five day average benchmarks. For example, when I do this I find the dates between the 9th and 12th of June 2009 to be false positives in that the first pass of the test causes them to be more than 5% lower than the average of both the preceding five days and the following five days. However, this is only because they are sandwiched between truly aberrant days (5th and 8th of June and 15th of June 2009). On the second pass of the test the dates between the 8th and 15th of June are found not to be aberrant while the 5th, 8th and 15th of June are confirmed as aberrant.

35 17 July 2008, 19 September 2008, 9 October 2008, 19 February 2009, 20 May 2009, 5 8 and 15 June 2009.

Figure 11: Absolute difference between CBASpectrum BBB+ yield and AER/Bloomberg BBB yield for 10 year maturity



Source: CBASpectrum, Bloomberg, CEG analysis. Note that CBASpectrum data for the 19 September (the week of the Lehman Brothers collapse, Merrill Lynch and AIG bailout) spiked to 16.56%. Similarly, data for 17 July 2008 also shows a 1.6% fall followed by a 2.2% rise the next day. Data for both dates (17 July and 19 September 2008) has been excluded from the above figures.

109. Consistent with the above graph I note that the level of disagreement between the two methods is clearly somehow related to the advent of the global financial crisis.

110. Both CBASpectrum and Bloomberg:

- rely on proprietary methods and information; and
- engage in non-transparent exercises of discretion and judgement when developing their fair value curves.

111. Bloomberg's methodology appears set the Bloomberg fair value curve for each credit rating based solely on bonds with that credit rating (albeit with Bloomberg excluding a large number of these bonds from its analysis for reasons that are not transparent).

By contrast, CBASpectrum uses data from all credit ratings and an assumed relationship between each of its fair value curves to simultaneously determine the shape and level of all of its fair value curves. This is an advantage of CBASpectrum's fair value estimate in the current market circumstances with limited bond pricing due to illiquidity and few new issues into the Australian corporate bond market in recent years.

112. The effect of Bloomberg's exclusion of some bonds from its analysis has the effect of lowering its estimate of fair values for BBB and for A credit ratings and to lower the slope of the fair value yield curve. It is difficult to establish the reasonableness Bloomberg's exercise of discretion as the basis for it is not transparent. However, to the extent that it reflects a desire by Bloomberg for its fair value curves to reflect fair value for liquid corporate bonds only[36] then Bloomberg fair value curves are, in my view, an inappropriate proxy for the benchmark rate in the current corporate bond market which is characterised by illiquidity.

113. The AER's methodology is likely to give rise to a biased estimate because it relies very heavily on the estimated Santos bond yield and that yield does not appear to be typical of BBB+ bonds. Neither CBASpectrum nor Bloomberg services contain data relating to bonds with 10 years to maturity and a BBB+ credit rating. Bloomberg attempts to bridge this impasse by assuming that a bond with a 10-year maturity will require approximately the same or lower premium that the longest dated BBB+ bond in its database, Santos. CBASpectrum moderates the shape and level of its BBB+ yield curve by reference to bond yields at other credit levels. Both of these approaches rely on the exercise of discretion in the face of a lack of data.

114. In this respect, Bloomberg's methodology, and by extension, the AER's methodology, currently relies almost exclusively on the observed yield of the Santos bond of 6.3 years maturity. In my view there is evidence that this bond is unrepresentative of long dated BBB+ bonds in general and, consequently, the AER's methodology will give rise to a biased estimate of the benchmark rate. Similarly, to the extent that Bloomberg's assumption that corporate bond spreads to CGS fall with maturity is incorrect then the AER's methodology will give rise to a biased estimate of the benchmark rate. Consistent with the advice of Professor Grundy at Attachment A, I consider that this may currently be the case.

115. Against this I note that CBASpectrum occasionally publishes aberrant estimates of fair value which CBASpectrum reverses almost immediately. I do not understand why this is the case but note that provided they are removed the existence of such aberrant estimates is not a basis for rejecting the reliance on CBASpectrum fair value estimates.

36 As might be suggested by page 9 of a presentation by Michael Lee to the International Bond Market Conference 2007, Taipei. Available at http://taipeibond.gretai.org.tw/cv/Bloomberg%20Mr.%20Lee(panel%203-1).ppt.

116. In summary, the two data services use proprietary information and their own discretion to develop their fair value curves. Without having regard to any other evidence, it is not possible to definitively conclude that one data service is superior to the other. Both data services bring expert judgment to bear and it is difficult to second guess the accuracy of these judgements in the absence of transparency in relation to where discretion has been used and what facts and objectives have guided the exercise of that discretion.

117. Nonetheless, there are reasons to consider that the AER's methodology for deriving a 10 year BBB estimate (from Bloomberg 8 year BBB, 10 year A and 8 year A fair value estimates) may be problematic in the current market conditions. This is because:

- Bloomberg's methodology works best where there are multiple bonds with similar maturity profiles within a given credit rating. This is not currently the case for BBB bonds in Australia with Bloomberg having only one pricing observation beyond 4 years (the Santos bond). By contrast, CBASpectrum's methodology uses information from all credit rating categories to simultaneously determine all credit rating fair value curves. This has the potential advantage of not relying solely on pricing for the limited set of BBB rated bonds to determine BBB rated fair value curves. (In periods with richer data sets it has the potential disadvantage of imposing a structure on term premia for a given credit rating that is inconsistent with the term structure implied by the bonds in that credit rating.)
- A reflection of the above point is that Bloomberg's fair value estimate of BBB at 8 years is unduly influenced by a single observation (being the Santos 6.38 year bond yield);
  - The above two dot points are reasons why CBASpectrum methodology may be preferred to AER/Bloomberg in meeting criterion ii listed at paragraph 39 above.
- Bloomberg's projection of fair value curves beyond the maturities for which it has data does not appear consistent with the shape of the fair value curves in earlier maturities where it does have data. In the absence of supporting data it is problematic to impose a falling spread to CGS as maturity increases. CBASpectrum's assumption of a flat to slightly increasing term structure for credit spreads appears more consistent with standard predictions from the finance literature.
  - The above dot point is a reason why CBASpectrum methodology may be preferred to AER/Bloomberg in meeting criteria ii and iii listed at paragraph 39 above.
- Bloomberg's exclusion of relatively high yielding BBB and A rated bonds from its curve construction may represent a desire by Bloomberg for its fair value curves to reflect the fair value for liquid corporate bonds - as opposed to fair value for the typical bond which in the current corporate bond market is not a liquid bond.

- The above dot points is a reason why CBASpectrum methodology may be preferred to AER/Bloomberg in meeting criterion i listed at paragraph 39 above (given that illiquidity is currently typical on bonds in the Australian corporate bond market).

118. Based on the analysis of this section it is my view that CBASpectrum estimates of BBB+ 10 year fair value are to be preferred to the AER's estimates of BBB+ 10 year fair value (based on Bloomberg BBB and A fair value curves). However, this is not a strong enough preference to suggest that zero weight should be given to the AER's methodology. However, I do conclude that the Bloomberg's estimates should not be given more weight than CBASpectrum's estimates.

119. While CBASpectrum's fair value methodology and estimates have properties that tend to make it relatively more desirable, the entirety of the difference between CBASpectrum and AER methods cannot necessarily be attributed to these desirable properties of the CBASpectrum method/outputs. It is possible that most of the difference reflects differences in expert judgement that is simply not possible to comment on given the nature of the proprietary methods used by each.

120. It cannot be ruled out that, were it possible to have regard to the proprietary methods and information, I would reverse the preference for CBASpectrum. For this reason it is important to have regard to other information external to the two data services. I do this in the next section.

4. Other considerations

121. This section has regard to other sources of information that provide further insight into the relative merits of CBASpectrum and AER/Bloomberg fair value estimates – and potentially alternative ways of arriving at an estimate of the benchmark rate.

4.1. Response to the global financial crisis

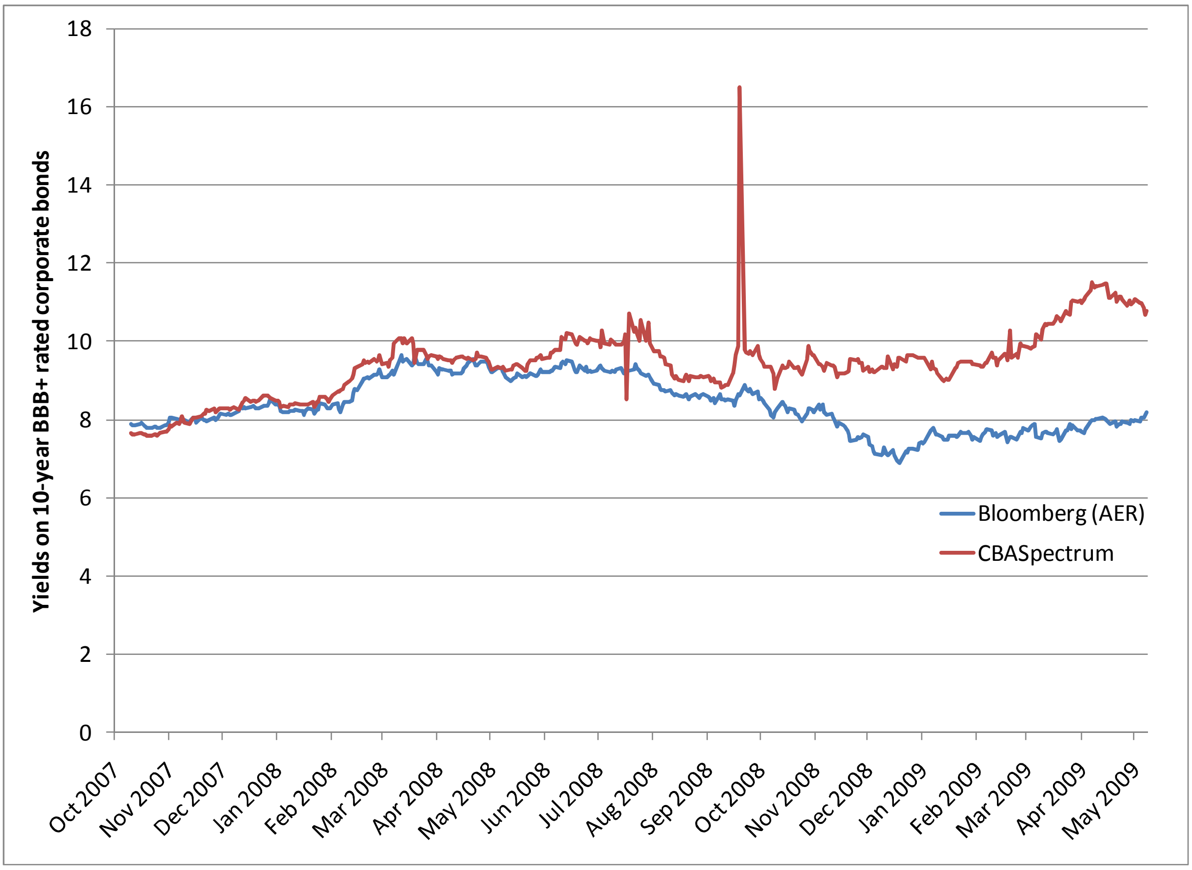
122. A relevant test of the appropriateness of the fair value estimates produced by Bloomberg and CBASpectrum is to compare the effect that the global financial crisis has had on these estimates. As discussed previously, it is widely agreed by market participants and commentators that the financial crisis has caused the yields and the premia on corporate bonds to increase. For example, the RBA noted in its November Statement of Monetary Policy that:

> *The deterioration of credit market conditions and the failure of several large financial institutions saw corporate debt yields increase significantly through September and October as default risk concerns escalated. Spreads on corporate debt surpassed their mid-March highs and 2000 peaks…*[37]

123. One would therefore expect fair value BBB+ bond yields to increase over the period September and October 2008. The following two figures allow one to compare the movements in both estimates of 10 year BBB+ fair value yields and the associated spreads to CGS yields.

[37] RBA, Statement on Monetary Policy, November 2008, page13

Figure 12: Estimated yields on 10-year BBB+ corporate bonds

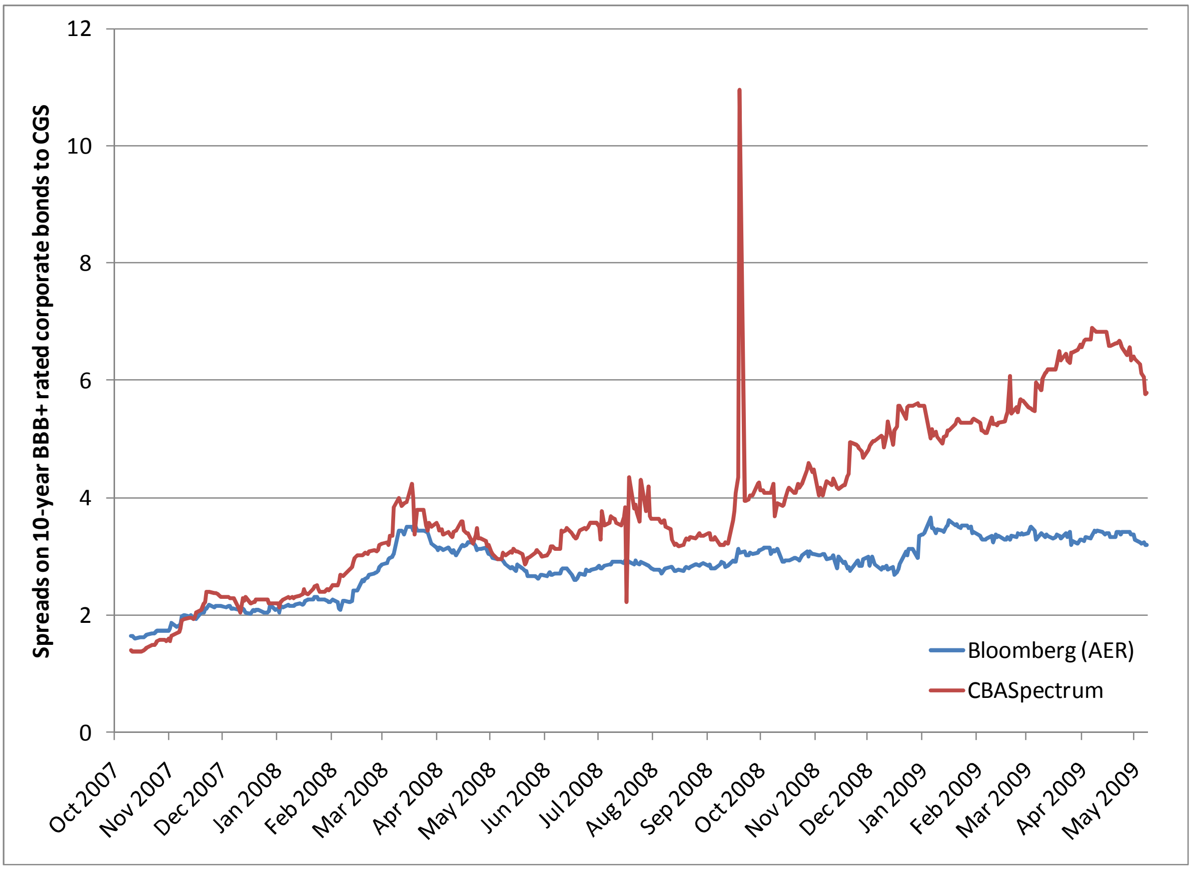


Source: Bloomberg, CBASpectrum

124. Figure 12 shows that yields on 10-year BBB+ corporate debt, as measured by the Bloomberg/AER methodology, gradually declined from a peak in March 2008 to the their lowest levels in December 2008, and have since increased slightly. On the other hand, CBASpectrum estimated that, on average, yields were approximately constant between March and December and have increased since then.

125. Figure 13 below shows a recent history of the debt premia over CGS estimated by Bloomberg and CBASpectrum for 10-year BBB+ bonds.

Figure 13: Estimated spreads to CGS on 10-year BBB+ corporate bonds



Source: Bloomberg, CBASpectrum

126. This figure shows that debt premia as estimated by Bloomberg did not change, or even decreased slightly, over the period between March and December 2008 and have since experienced a slight increase. There appears to be no significant reaction to the events of September and October 2008. On the other hand, the premia estimated by CBASpectrum have increased strongly since September 2008, with this trend only recently reversing.

127. On the basis of Figure 12 and Figure 13 above, I consider it reasonable to conclude that CBASpectrum's fair value estimates better reflect the understanding of market participants about the effects of the financial crisis on the cost of debt. Specifically, although CBASpectrum shows yields to be approximately constant following September 2008, this represents an increase in the debt premium, given the contemporaneous decline in yields on CGS. Bloomberg's estimates show yields on 10-year BBB+ debt to be falling since the escalation of the crisis in September 2008, with the result that debt premia have been largely unchanged over this period.

128. This appears to be an example where the movement in (as opposed to level of) CBASpectrum fair value estimates was more consistent with reflecting current market conditions as per criteria iv at paragraph 39.

4.2. Consistency with actual recent BBB+ debt issued by Tabcorp

129. Tabcorp announced the issue of a 5 year BBB+ rated bond on 24 March 2009. The Tabcorp bond issue is significant because it is the first issue of an Australian non-financial corporate bond in more than a year.[38] It is also highly relevant because it is a 5 year Standard and Poor's BBB+ rated bond.

130. While the Tabcorp bond issue is a 5 year issue and not a 10 year issue, based on the then upward sloping yield curve the yield on the Tabcorp bond is reasonably interpreted as a lower bound estimate of the yield Tabcorp would have to offer on a 10 year BBB+ issue. The current Tabcorp bond issue therefore provides important current information on the yield demanded by investors at the initial issue of BBB+ debt in the current environment.

131. Tabcorp is a BBB+ rated entity and is issuing debt which Standard and Poors has confirmed will also be rated at BBB+.[39] This bond will have a five year maturity.[40] It will pay a floating interest rate which is reset every three months to be equal to the then prevailing 3 month bank rate plus a margin of 400bp to 450bp.[41] On 1 April 2009 Tabcorp announced the results of a bookbuild process that set the margin in the middle of this range at 425bp.[42] Tabcorp will also pay a 'bonus' interest payment of 0.25% for the first year to some retail investors.[43] The issue size is expected to be around $200m.[44]

4.2.1. Interest costs on the Tabcorp BBB+ debt issue

132. The Tabcorp offer is a floating rate offer referenced to the 3 month BBSW rate. This means that in order to estimate the full yield of the Tabcorp issue one must add the five year swap rate.

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38 http://www.reuters.com/article/rbssConsumerGoodsAndRetailNews/idUSSYU00622420090320.

39 See ASX announcement at http://www.asx.com.au/asxpdf/20090325/pdf/31grrc2xd1nf59.pdf.

40 See page 6 of the Prospectus for the issue of Tabcorp bonds at http://www.asx.com.au/asxpdf/20090324/pdf/31gqwq62d8gqvs.pdf.

41 See section 1.15 of the Prospectus for the issue of Tabcorp bonds.

42 See http://www.asx.com.au/asxpdf/20090401/pdf/31gvxc5xsd8t2c.pdf.

43 See page 6 of the Prospectus for the issue of Tabcorp bonds.

44 See ASX announcement http://www.asx.com.au/asxpdf/20090330/pdf/31gtthwsynzsry.pdf.

133. The actual process that Tabcorp would follow (and may well have followed) to achieve this fixed rate would be to hedge its floating rate liability associated with the bond by entering into a contract with a third party to pay that third party a fixed yield over 5 years in exchange for the third party paying Tabcorp a floating liability based on the 3 month bank bill rate. This is termed a 'fixed for floating swap'. In effect, Tabcorp would promise to pay a fixed coupon to the third party over five years and the third party would promise to pay Tabcorp the bank bill rate over those five years.

134. By entering into this transaction Tabcorp would be able to use the bank bill payments from its swap agreement to pay the bank bill related costs on its floating rate bond. This would leave Tabcorp with a net liability equal the fixed component of its swap agreement plus the fixed margin above the bank bill rate on its floating rate bond. That is, the net position would be identical to having issued a fixed coupon bond.

135. Such transactions are commonplace in financial markets and it is quite possible that this is precisely what Tabcorp did. Of course, Tabcorp does not have to enter into a 5 year swap. It can leave itself exposed to variations in the bank bill rate over the five years. However, the market price of bearing this risk itself is given by the 5 year swap rate.

136. There are two sensible dates on which to measure the swap rate for this purpose. The first is 24 March 2009 (the day of the announcement of the offer) which is the day Tabcorp committed to issue the debt at a specified margin (between 400bp and 450bp) above the swap rate. The 5 year swap rate was 4.34% on that day. The second is 1 April 2009 being the date that the margin was established in the middle of this range. The swap rate was 4.36% on that day.

137. The table below provides the relevant calculations to come to a five year estimate of the cost of debt. It also compares this with the Bloomberg and CBASpectrum estimates of the cost of debt for a 5 year BBB+ bond.

Table 4: Cost of debt based on 432bp margin above the swap rate

Date	24 March 2009	1 April 2009
Swap rate	4.34%	4.36%
Tabcorp 5 year issue (swap rate plus 4.25%)	**8.59%**	**8.61%**
5 year BBB+ fair value estimated		
Bloomberg	7.47%	7.48%
CBASpectrum	9.65%	9.94%

*Source: CBASpectrum, Bloomberg and CEG analysis. Note the figures in this table are not annualised and so differ slightly from the estimates used in the AMI submission by Victorian electricity distributors.

138. This table states that Tabcorp is issuing at a 5 year equivalent fixed annualised yield in excess of 8.59% (I say in excess because Tabcorp will also have to pay bonus interest on some proportion of its offer). The immediate next observation from this table is that Tabcorp is issuing at a yield that is very close to the middle of Bloomberg and CBASpectrum estimates for fair value at a BBB+ rating. On this basis the Tabcorp issue would tend to support the use of an average of CBASpectrum and Blooomberg fair value estimates at 5 year maturity.

139. However, this logic presumes that Tabcorp is regarded by both data services as having the average risk for a BBB+ issuer. In reality both data services treat Tabcorp as being lower risk than average for a BBB+ bond. Tabcorp has another bond on issue with a 2.5 year to maturity covered by both Bloomberg and CBASpectrum.[45] On the 24th of March 2009 CBASpectrum estimated that this bond's fair value was 1.47% less than the average fair value for a BBB+ bond.[46] On the same day, Bloomberg estimated its fair value to be 0.20% lower than the average. (On 1 April CBASpectrum/Bloomberg estimated this bond to have a fair value yield that was 0.85%/0.05% lower than the average).

140. When this fact is taken into account it follows that consistency of estimates would predict that both data services' 5 year fair value BBB+ estimates would overestimate the yield on the Tabcorp 5 year bond (just as they overestimate the yield on the 2.5 year Tabcorp bond). This makes the fact that Bloomberg underestimates the 5 year Tabcorp bond yield more surprising. It also suggests that CBASpectrum's 5 year BBB+ fair value estimate may be more reliable than Bloomberg's 5 year BBB fair value estimate (to the extent that one accepts that both Bloomberg and CBASpectrum's classification of Tabcorp's 2.5 year bond as lower than average risk implies that Tabcorp's 5 year bond should also be regarded as having lower than average risk).

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45 There is only one Tabcorp bond covered by Bloomberg and CBASpectrum and this bond matures in 2.53 years time (on 13 October 2011). This maturity is associated with a 2.53 year time to maturity from 1 April 2009.

46 This involves a comparison of the fair value estimate for the 2.53 years to maturity Tabcorp bond with the interpolation between 2 and 3 year fair value maturity for BBB+.

141. It is also worth noting that the AER average BBB+ 10 year fair value estimate[47] is well below the actual issue yield for the 5 year Tabcorp issue. That is, not only does the Bloomberg 5 year BBB+ fair value estimate underestimate the 5 year Tabcorp issue yield but so does the Bloomberg 10 year BBB+ fair value estimate. The magnitude of this underestimate is described in the below table.

Table 5: Bloomberg 10 year underestimates Tabcorp 5 year

Date	24 March 2009	1 April 2009
Tabcorp 5 year issue (annualised)	8.59%	8.61%
Bloomberg 10 year estimate (annualised	7.73%	7.70%
Difference to actual yield of Tabcorp 5 year issue	-0.86%	-0.91%

Source: Bloomberg and CEG analysis

4.2.2. Direct costs of debt issuance

142. A further reason to believe that Bloomberg 5 year estimate is an underestimate of the cost of debt is the fact that the Tabcorp issue was a retail issue rather than a wholesale issue. That is, the Tabcorp issue was open to small investors as well as institutions. The direct costs of staging and marketing a retail issue are materially higher than a wholesale issue but the 'pay off' for doing so is that a lower interest rate needs to be paid. (This is the only reason a firm would rationally opt for a higher cost retail issue).

143. Consequently, the interest rate paid by Tabcorp should be treated as an underestimate of the interest rate Tabcorp would pay on a wholesale issue by at least the different in direct costs. Section 7.6 of the Tabcorp prospectus details the fees and expenses associated with the debt issue. These fees and expenses include:

- up to 1.5% of the total issue value in Arranger fees;
- up to 0.75% of the total issue value in fees to the 3 other Joint Lead Managers who are not Arrangers;
- fees of 2.0% on the total value of bonds allocated in the Broker Firm Offer;
- Out of pocket expenses. These include the expenses incurred by Joint Lead Managers (eg, legal expenses, transaction taxes, the cost of operating and staffing a 1300 information line Monday to Friday between 8.30am and 5.30pm).

[47] As calculated by the AER. That is, Bloomberg does not publish a 10 year BBB+ fair value yield but it is the AER's practice to add to the 8 year BBB+ yield Bloomberg's estimate of the difference between 10 and 8 year A rated fair value yields.

- Fees paid to and expenses incurred by the Trustee (who holds the bonds on trust for the borrowers) (see section 7.5 of the prospectus).

144. Assuming that the maximum fees are paid to the Arrangers and other Joint Lead Managers then these alone would represent 2.25% of the amount raised. A payment of 2.25% of the total amount raised amortised at 8%[48] over the five years of the bonds life amounts to a 56bp per annum cost.

145. However, the estimate of 2.25% (56bp per annum) must be increased to reflect fees for placements through Broker Firm Offers and out of pocket expenses (such as legal expenses etc). If one assumes that only 25% of the debt is issued through Broker Firm Offers then this fee will still amount to 0.5% of the total value of the issues. This raises the total direct cost of the issue to 2.75%.

146. One must also add to this an estimate of other direct costs. The AER NSW distribution draft decision estimates this to be around $200,000 in total (including legal and roadshow costs, credit rating fees and other minor costs) which represents around 0.1% of a total issue value $200m. Reviewing the documentation for the Tabcorp issue and noting the use of a staffed information phone line it appears likely to us that the other out of pocket expenses are likely to be well in excess of that allowed in the draft decision. Nonetheless, adding 0.1% to 2.75% gives a total upfront cost of 2.85%.

147. A 2.85% upfront cost means that for every $100 raised there is only $97.15 raised in net. A 2.85% upfront cost therefore translates to 2.93% of the net proceeds. Amortising 2.93% over 5 years at an 8% discount rate gives an annual debt raising cost of 0.73% pa. This is 0.65% higher than the AER's estimate of around 0.08% direct costs for a wholesale issue (based on wholesale issue into the US market).[49] If we add 0.65% to the Tabcorp issue yield we find that it is much closer to the CBASpectrum fair value estimate than the Bloomberg fair value estimate.

4.2.3. Conclusion

148. The Tabcorp bond is the best observation available of a recently traded BBB+ bond with a medium term maturity. Importantly, it is also an observation of the cost of debt *to an issuer* and therefore is desirable as a source of information on the benchmark rate (see criterion i at paragraph 39). The yield at issue on the Tabcorp bond issue can reasonably be viewed as an underestimate of the benchmark rate because:

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48 I conservatively assume a cost of capital of only 8%.

49 See page 187 of the AER 28 April 2009 Final Decision for NSW electricity distributors.

- The issue was a retail issue and, as such, incurred higher direct transaction costs in reaching retail customers with the pay-off for incurring these costs being lower interest costs paid by Tabcorp;
- Tabcorp's pre-existing 2.5 year to maturity bond is treated by both data services as lower than average risk for a BBB+ entity.

149. This observation provides a clear basis for believing that Bloomberg fair value estimates underestimate the benchmark rate. The fact that CBASpectrum 5 year BBB+ fair value estimate overestimates the yield on the 5 year Tabcorp bond provides some evidence that CBASpectrum may overestimate the benchmark yield. However, this is ambiguous because, for the reasons provided above, the yield on the 5 year Tabcorp bond can be regarded as itself an underestimate of the average BBB+ bond yield.

150. Of course, the Tabcorp issue is only one observation for one bond. However, the AER/Bloomberg methodology is also effectively based on a single bond (as described above, Santos drives the value of the Bloomberg BBB 8 year fair value). There is also no evidence that the Blooomberg Santos price reflects an actual trade of the bond as opposed to an estimate of its yield. In addition, the Bloomberg estimate for Santos is based on an estimate of the yield associated with a trade in the secondary market not the interest costs to the issuer (as is the case for the Tabcorp observation).

151. On this basis, to the extent that one was required to set the benchmark on the basis of a single observation it would be preferable for that observation to be based on the actual traded price for the Tabcorp new issue than on a Bloomberg estimate of the hypothetical secondary market traded price for Santos.

4.3. RBA estimates of debt risk premiums

152. The Reserve Bank of Australia reports estimated of spreads between corporate bonds and CGS. The most recent of these estimates is for 31 March 2008. This is compared with CBASpectrum and AER/Bloomberg estimates on the same day.

Table 6: RBA vs AER vs CBASpectrum on 31 March 2009

	BBB Credit rating
AER 10 years BBB	3.27%
CBASpectrum 10 years BBB+	6.60%
RBA (1 - 5 years)*	5.74%

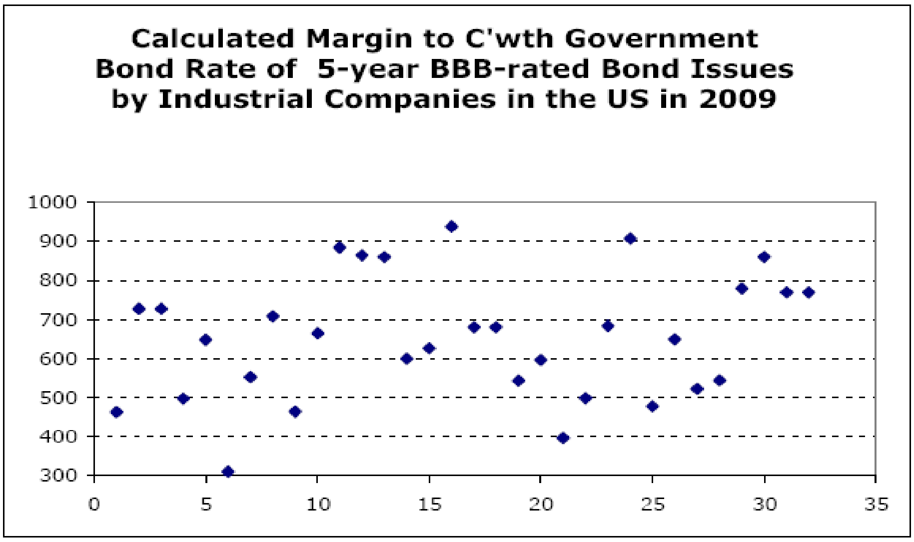
**Source: RBA, Table F.3 Capital Market Yields and Spreads – Non-government Instruments.*

153. Clearly, the RBA reported credit spreads are closer to, although still below, CBASpectrum estimates than AER/Bloomberg estimates. However, it must be noted that the RBA estimates are an average over bonds that have one to five years to maturity. Consequently, these can be expected to be an underestimate for the credit spread at 10 years based on an upward sloping term premia for credit spreads exists.

4.4. BBB new issue premiums to Bloomberg fair value

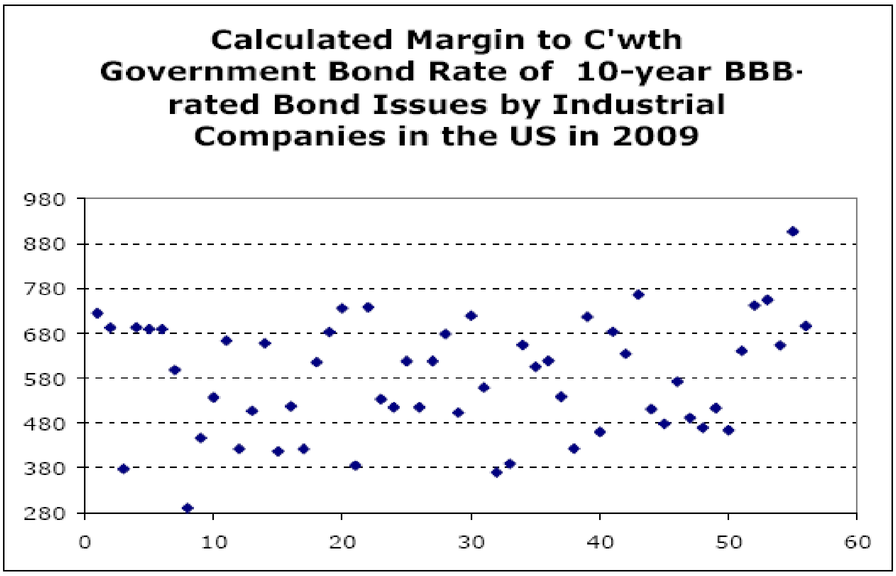
154. A recent analysis by Victorian electricity distribution businesses[50] suggests that in the US the Bloomberg fair value curves significantly underestimate the cost of interest to the bond issuer. I reproduce this analysis in full here.

> *The graphs below show yields (swapped to A$ at the time of issuance) on BBB and BBB+ rated bonds issued in the US by industrial companies this year, as a spread to Commonwealth bonds. There have been many issues in the US so far this year so it is a reasonably deep and liquid market in which to observe new issue spreads.*
>
> *The graph below shows the calculated margin to the Commonwealth Government bond rate of 5-year BBB/BBB+ rated bond issues by industrial companies in the US in 2009. The average 5-year BBB/BBB+ rated debt margin (over the Commonwealth bond rate) is 663 basis points.*

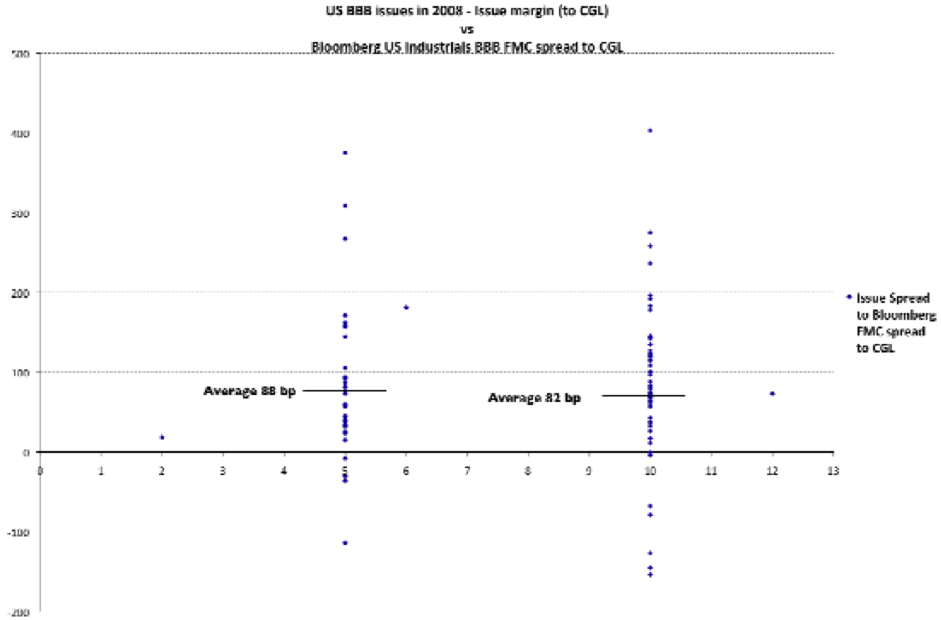


50 *Debt Risk Premium for use in the Initial AMI WACC Period*, A paper jointly prepared by the Victorian Electricity Distribution Businesses, 1 June 2009. See attachment 3.

The graph below shows the calculated margin to the Commonwealth Government bond rate of 10-year BBB/ BBB+ rated bond issues by industrial companies in the US in 2009. The average 10-year BBB/BBB+ rated debt margin (over the Commonwealth bond rate) is 581 basis points.



The chart below shows approximately 100 US bond issues in 2008 as a spread to the Bloomberg US fair yield curve. As is the case in Australia, the US fair yield curves imply spreads to the risk-free that are materially lower that the new issue spreads observed for corporate bonds.



155. Two important observations can be made about this data. First, the cost of issuing 5/10 year BBB/BBB+ rated debt into the US market and converting those interest rates into Australian dollars is around the same or higher than the cost of issuing 10 year BBB+ debt predicted by CBASpectrum and higher than the cost predicted by Bloomberg.[51]

156. Second, there is a significant new issuance premium evident in the US data. That is, debt is mostly issued at a yield that is higher than the equivalent Bloomberg fair value estimate in the US. This is consistent with the advice received from Bloomberg by the Victorian businesses that precisely the above was to be expected for new issues.

> *Bearing in mind that the curves are representative of secondary market prices and trading sizes, new issues have nearly always been issued at a premium to this curve. In settled market conditions, the premium required to 'get away' a new issue might have been quite small. My experience has been that the premium has increased during this period of market turbulence as buyers have demanded a greater risk premium.*[52]

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[51] The average spread to CGS from a 5/10 year US issuance strategy in 2009 is reported as 663bp/581bp. This compares to an average Bloomberg fair value BBB estimate of 336bp and an average CBASpectrum BBB+ fair value estimate of 586bp over the period 1 January 2009 to 20 May 2009.

[52] *Debt Risk Premium for use in the Initial AMI WACC Period*, A paper jointly prepared by the Victorian Electricity Distribution Businesses, 1 June 2009, page 17.

157. Given that the criteria i at paragraph 39 requires that the benchmark rate reflect the cost to the issuer of debt, this is further evidence that the AER/Bloomberg methodology will underestimate this cost for typical BBB+ 10 year debt.

4.5. Bonds issued by Australian corporates into the US market

158. An alternative to issuing BBB+ debt in Australia is to issue BBB+ debt in the US and to enter into a currency swap to convert that US dollar debt liability into Australian dollar liability. A recent analysis by Victorian electricity distribution businesses has undertaken this analysis and I reproduce their results here.

> *The table below shows 5, 7 and 10-year US dollar bond issues by Australian non-bank companies in the US, with the effective swap back to A$ as a spread to the Commonwealth bond rate, had the issuers entered into a cross-currency swap to fixed rate A$ at the time of the issue.*

5-year maturity						
Company	**Spread at issue**	**Effective Spread over Aus CGL (annualised)**	**Launch/ Announcement Date**	**Issue Type**	**Issue Amount**	**Rating**
QBE Insurance	770	821	30-Dec-08	144a reg S	US$210mn	A3/A-
Woodside	625	633	24-Feb-09	144a reg S	US$400mn	Baa1/A-
Brambles	550	5	18-Mar-09	144a reg S		NAIC-2
BHP Billiton	400	418	14-Apr-09	US Public - SEC registered	US$1.55bn	A1/A+
Rio Tinto	752	813	25-May-09	US Public - SEC registered	US$2bn	Baa1/BBB
Woodside	602	633	25-May-09	144a reg S	US$400mn	Baa1/A-
Westfield	549	602	27-May-09	144a reg S	US$400mn	Baa1/A-

7-year maturity						
Company	**Spread at issue**	**Effective Spread over Aus CGL (annualised)**	**Launch/ Announcement Date**	**Issue Type**	**Issue Amount**	**Rating**
Brambles	550	607	15-Mar-09	USPP		NAIC-2
APA Pipelines	575	641	14-May-09	USPP	US$65m	BBB

10-year maturity						
Company	**Spread at issue**	**Effective Spread over Aus CGL (annualised)**	**Launch/ Announcement Date**	**Issue Type**	**Issue Amount**	**Rating**
BHP Billiton	400	499	18-Mar-09	US Public - SEC registered	US$1.75bn	A1/A+
Woodside	613	686	24-Feb-09	144a reg S	US$600m	A-
Brambles	550	652	15-Mar-09	144a reg S		NAIC-2
Rio Tinto	658	804	14-Apr-09	US Public - SEC registered	US$1.5bn	Baa1/BBB
APA Pipelines	575	754	14-May-09	144a reg S	US$75m	BBB
Woodside	551	686	25-May-09	144a reg S	US$600mn	Baa1/A-

159. This table has six 10 year bond issues into the US market by Australian businesses between 15 March and 25 May. The average credit rating is above BBB. The average estimated credit spread on these issues is 680bp (median is 686). By contrast, over the same period the average credit spread predicted by the AER/CBASpectrum was 3.35%/6.58%. This evidence provides further support for the view that the AER method underestimates the cost of issuing BBB debt in the current market conditions.

5. AER analysis in 2009 NSW Electricity Distribution Decision

160. The AER concluded that its method, based on Bloomberg fair value estimates, was superior to the CBASpectrum fair value estimates for 10 year BBB+ bond yields. The AER analysis did not address the range of considerations examined in the previous two sections.

161. In addition, the AER analysis was based on a number of factual errors including:

- That prices quoted by Bloomberg reflected actual trades (multiple references, eg, see note (b) to table 11.4 suggesting that unlike other bonds the BBI Bloomberg estimates were not a traded price);
- That CBASpectrum but not Bloomberg imposes the condition that fair value curves for different ratings do not cross;[53]
- That the Babcock and Brown Infrastructure (BBI) bond was rated, as at March 2009, as A- in CBASpectrum despite being re-rated as BBB+ by Standard and Poor's on 6 June 2008.[54]

162. In addition, I consider that the AER analysis involved important methodological flaws including:

- The proposed tests (in Tables 11.4 and 11.5 on page 228) of the accuracy of Bloomberg versus CBASpectrum's fair value estimates were not properly constructed in that:
  - the tests do not measure what is important – which is the accuracy of the AER's method of deriving a *10 year* BBB+ yield from Bloomberg fair value estimates against that of CBASpectrum's 10 year BBB+ fair value estimate; and
  - the tests actually measured the accuracy of each data service's fair value estimate in predicting the yield on the *lowest yielding* bonds in each data service. It is only to be expected Bloomberg, with the lowest fair value estimate, is the most 'accurate' when measured against this benchmark.

[53] page 230.

[54] page 231, had the AER searched in CBASpectrum by sorting bonds into credit rating it would have seen this BBI bond was listed under BBB+, ie, CBASpectrum had correctly categorised the bond by rating. It is correct that once this bond is brought up in CBASpectrum an A- rating is still reported for it which is a past credit rating. However, this is not how this bond is actually stored in CBASpectrum's data base (it is stored as a BBB+ bond).

However, for this test to be of any relevance one must have already determined that the lowest yielding bonds are the relevant benchmark against which the data services should be tested. In my view the AER did not establish this and, therefore, the tests are not relevant.

- That it is appropriate to introduce a concept of 'market perceived credit rating'[55] that differs from the 'Standard and Poor's credit rating'. The 'market perceived credit rating' is not well defined by the AER but appears to be used by the AER rule out having regard to high yielding BBB+ rated (and even higher rated) bonds. This methodology appears to have a strong flavour of 'catch 22' logic. Namely, if a bond has a high yield then it will be defined as having a 'market perceived credit rating' that is below BBB+ even if its actual Standard and Poor's credit rating is BBB+ or above.
- That even if one accepted that it was appropriate to stop having regard to Standard and Poor's credit ratings and instead attempt to derive a 'market perceived credit rating' there is no reason to simply presume that high yielding bonds in a particular credit rating have a 'market perceived credit rating' that is lower than their credit rating. The opposite could equally be true and low yielding bonds could be construed as having a 'market perceived credit rating' that is above their Standard and Poor's credit rating. Credit ratings are by their nature relative and the AER has no basis for assuming that only the low yielding bonds in a Standard and Poor's credit rating 'belong' in that rating.

[55] page 231.

6. Conclusion

163. On the basis of the evidence in this report, I do not consider that sole reliance on the Bloomberg fair value estimates for estimating the benchmark rate (as per the AER methodology) is reasonable. Such a method, when measured against the criteria developed in section 2 would perform poorly.

   i. It would not reflect a representative yield at the time of issue for 'typical' corporate bonds with a maturity of 10 years and a BBB+ long-term credit rating from Standard & Poor's. Rather, it would in effect rely almost entirely on the Bloomberg estimate of the fair value for a single bond being the Santos bond;
   ii. It would utilise a methodology that is unnecessarily reliant on a single or small number of observations and/or individual views and would not efficiently use the totality of information available, particularly given that the available information is sparse;
   iii. It would give rise to estimates that are inconsistent with standard predictions of finance theory in that it would impose a downward sloping term structure for credit spreads (and inconsistent with a clear upward slope where there is available data);
   iv. It would not give rise to estimates that are consistent with current market conditions and would not have captured the impact of clear changes in market conditions in September and October 2008; and
   v. It would give rise to yield estimates that are not consistent with other potential proxies for the benchmark rate as described in Section 4 of this report.

164. The CBASpectrum BBB+ 10 year fair value yield performs better against these criteria. It does not rely on a single observation but rather employs a method that uses all the available bond data – a method that will work relatively better than the Bloomberg methodology in the presence of limited data. It gives rise to estimates that are more consistent with other information and it did capture the expected movement in credit spreads following the events of September and October 2008. However, this does not imply that 100% weight should be given to this source for an estimate of the benchmark rate. The CBASpectrum estimate tended to overestimate the only recent observed issue price for a BBB+ Australian bond (the Tabcorp issue) and also was higher than the rates reported by the RBA (although the difference in both cases was less pronounced than for the Bloomberg under-estimates).

165. For these reasons, if one was required to rely on one or the other of the two estimates of fair value as a proxy for the benchmark rate then I would rely on CBASpectrum's 10 year BBB+ estimate. I do not believe it would be reasonable to rely solely on the

Bloomberg estimate of fair value. However, absent a requirement to select a single data service then a conservative approach would be to give weight to the facts and expert opinions embodied in both services. However, in my view it would not be appropriate to give more weight to the Bloomberg estimates than the CBASpectrum estimates.

166. I note that an alternative approach would be to rely on neither data services estimate of fair value. In theory it may be possible to develop an alternative procedure for estimating the benchmark rate that does not rely on either Bloomberg nor CBASpectrum fair value estimates.

167. A problem with this approach is that it will inevitably require the exercise of significant judgment and this is especially true in the current market conditions with little in the way of observations of actual trades or issue of Australian BBB+ bonds. Ultimately this is likely to score poorly against criteria vi at paragraph 40:

vi the source of the estimate would be as independent as possible from interested parties to the regulatory proceedings.

168. In this context, the fact that Bloomberg and CBASpectrum develop their estimates independently of parties to the proceedings may actually be a sufficiently important advantage to outweigh the disadvantage that they are not specifically designed for the purpose of estimating the cost to be used in regulatory determinations.

169. One option that would score well against all criteria at the current time would be to adopt an estimate of the debt risk premium based solely on the observed debt risk premium in the Tabcorp issue. However, as time passes and market conditions evolve this estimate will tend to lose relevance.

Attachment A: Grundy Note

Theoretical and Empirical Models of the Term Structure of Debt Margins
Bruce D. Grundy
26 May, 2009

This Note examines the theoretical link between debt margins and debt maturity. Part 1 develops a simple model of the link between debt maturity and debt margins. Part 2 estimates the theoretical shape of the term structure of debt margins by implementing an extension of the seminal Merton (1974) model of the pricing of risky zero-coupon debt. The extension includes both coupon payments and bankruptcy costs. Theoretical debt margins are calculated for bonds of varying maturity and debt-to-asset ratios of 60%. Part 3 reviews the available empirical evidence on the term structure of observed debt margins for BBB bonds.

Part 1 A simple model of the link between debt maturity and debt margins

Assume that the term structure of default-free rates is flat.

$\delta \equiv$ the bond's recovery rate; i.e., the fraction of the contractual amount due that bondholders receive in the event of a default. $\delta = 0$ corresponds to the situation where bankruptcy costs consume the entirety of a firm's remaining assets.

$y(T;\delta) \equiv$ yield on a par-valued coupon-paying bond promising to pay annual coupons and the principal amount *K* at time *T.*

$B(c,T,K;\delta) \equiv$ market value of a *T*-period bond with principal outstanding of *K* and an annual coupon rate of *c* given a recovery rate of δ .

$r_f \equiv$ the annual risk-free rate.

$\tilde{\Pr}(T,t) \equiv$ the risk-neutral probability that default on the *T*-period bond first occurs at time *t*. $\left[1-\tilde{\Pr}(T,t)\right]$ is then the risk-neutral year *t* survival rate given that the bond has not defaulted prior to year *t*.

The value of a bond is the sum of the bond's risk-neutralized expected future payoffs discounted at the risk-free rate.

$$B\left(c,T,K;\delta\right)=\sum_{t=1}^{T}\frac{\left[\prod_{\tau=1}^{t-1}\left[1-\Pr\left(T,\tau\right)\right]\right]\times\left[\left[1-\Pr\left(T,t\right)\right]+\Pr\left(T,t\right)\times\delta\right]\times c\times K}{\left[1+r_f\right]^t}$$
$$+\sum_{t=1}^{T}\frac{\left[\prod_{\tau=1}^{t-1}\left[1-\Pr\left(T,\tau\right)\right]\right]\times\Pr\left(T,t\right)\times\delta\times K}{\left[1+r_f\right]^t}+\frac{\left[\prod_{\tau=1}^{T}\left[1-\Pr\left(T,\tau\right)\right]\right]\times K}{\left[1+r_f\right]^T}. \quad (1)$$

In general $\Pr\left(T,\tau\right)\neq\Pr\left(T\right)\forall\tau\leq T$. But we can approximate the market value of a bond by replacing each of the $\Pr\left(T,\tau\right)$ in (1) by a constant amount $\Pr\left(T\right)$ defined such that $1-\Pr\left(T\right)=\left[\prod_{\tau=1}^{T}\left[1-\Pr\left(T,\tau\right)\right]\right]^{1/T}$ i.e., such that the corresponding annual risk-neutral survival rate $\left[1-\Pr\left(T\right)\right]$ is equal to the *T*-period geometric average of the set of risk-neutral annual survival rates $\left[1-\Pr\left(T,\tau\right)\right], \tau=1,\ldots,T$. The approximate relation is

$$B\left(c,T,K;\delta\right)\approx\sum_{t=1}^{T}\frac{\left[\prod_{\tau=1}^{t-1}\left[1-\Pr\left(T\right)\right]\right]\times\left[1-\Pr\left(T\right)\left(1-\delta\right)\right]\times c\times K}{\left[1+r_f\right]^t}$$
$$+\sum_{t=1}^{T}\frac{\left[\prod_{\tau=1}^{t-1}\left[1-\Pr\left(T\right)\right]\right]\times\Pr\left(T\right)\times\delta\times K}{\left[1+r_f\right]^t}+\frac{\left[\prod_{\tau=1}^{T}\left[1-\Pr\left(T\right)\right]\right]\times K}{\left[1+r_f\right]^T}.$$

When in fact $\Pr\left(T,\tau\right)$ is equal to $\Pr\left(T\right)\forall\tau\leq T$ then the yield on a par-valued bond $y\left(T;\delta\right)$ satisfies

$$K = \sum_{t=1}^{T} \frac{\left[\prod_{\tau=1}^{t-1}\left[1-\Pr(T)\right]\right]\times\left[1-\Pr(T)(1-\delta)\right]\times y(T;\delta)\times K}{\left[1+r_f\right]^t} + \sum_{t=1}^{T}\frac{\left[\prod_{\tau=1}^{t-1}\left[1-\Pr(T)\right]\right]\times\Pr(T)\times\delta\times K}{\left[1+r_f\right]^t} + \frac{\left[\prod_{\tau=1}^{T}\left[1-\Pr(T)\right]\right]\times K}{\left[1+r_f\right]^T}.$$

Cancelling K from both sides gives

$$1 = \sum_{t=1}^{T} \frac{\left[1-\Pr(T)\right]^t \times y(T;\delta)}{\left[1+r_f\right]^t} + \frac{\left[1-\Pr(T)\right]^T}{\left[1+r_f\right]^T} + \sum_{t=1}^{T}\frac{\left[1-\Pr(T)\right]^{t-1}\times\Pr(T)\times\delta\times\left[1+y(T;\delta)\right]}{\left[1+r_f\right]^t}. \qquad (2)$$

Relation (2) can be rewritten as

$$1 = \sum_{t=1}^{T} \frac{\left[1-\Pr(T)\right]^{t-1}\times\left[\left[1-\Pr(T)\right]\times y(T;\delta)+\Pr(T)\times\delta\times\left[1+y(T;\delta)\right]\right]}{\left[1+r_f\right]^t} + \frac{\left[1-\Pr(T)\right]^T}{\left[1+r_f\right]^T}$$

$$= \sum_{t=1}^{T}\frac{\left[y(T;\delta(T))+\frac{\Pr(T)\times\delta}{\left[1-\Pr(T)\right]}\times\left[1+y(T;\delta)\right]\right]}{\left[\frac{1+r_f}{1-\Pr(T)}\right]^t} + 1\Big/\left[1+\frac{\Pr(T)+r_f}{1-\Pr(T)}\right]^T$$

$$= A\left(\frac{\Pr(T)+r_f}{1-\Pr(T)},T\right)\left[y(T;\delta)+\frac{\Pr(T)\times\delta}{\left[1-\Pr(T)\right]}\times\left[1+y(T;\delta)\right]\right] + 1\Big/\left[1+\frac{\Pr(T)+r_f}{1-\Pr(T)}\right]^T,$$

where $A(i,T)$ denotes the present value of an annuity of \$1 to be received at the end of each of *T* years with the first payment due in one year's time given a per annum discount rate of *i*. Solving for $y(T;\delta)$ gives

$$y(T;\delta)=\frac{\frac{\Pr(T)+r_f}{\left[1-\Pr(T)\right]}-\frac{\Pr(T)\delta}{\left[1-\Pr(T)\right]}}{1+\frac{\Pr(T)\delta}{\left[1-\Pr(T)\right]}}=\frac{\Pr(T)+r_f-\Pr(T)\delta}{1-\Pr(T)+\Pr(T)\delta}. \qquad (2)$$

$$1+y(T;\delta)=\frac{1+r_f}{\left[1-\Pr(T)\right]+\Pr(T)\delta}.$$

Now consider the yield given the two extremes of the recovery rate, $\delta=1$ and $\delta=0$. A recovery rate of $\delta=1$ corresponds to a situation where despite (technical) default the bondholder still receives 100% of the principal and accrued interest owed him or her. Not surprisingly, substitution in (2) yields the result that $y(T;1)=r_f$. At the other extreme a zero recovery rate corresponds to a situation where default costs consume the entirety of any potential payoff to the bondholders. In this case substitution in (2) yields the simply and logical result that $y(T;0)=\frac{r_f+\Pr(T)}{1-\Pr(T)}$; i.e., $1+r_f=\left[1-\Pr(T)\right]\left[1+y(T;0)\right]$. Since the risk-neutral probability of the bond <u>not</u> defaulting in any year is $\left[1-\Pr(T)\right]$, the risk-neutral expected one-plus-annual yield on risky debt of $\left[1-\Pr(T)\right]\times\left[1+y(T;0)\right]$ is equal to the one-plus-annual risk-free rate.

Let $M(T;\delta)$ denote the debt margin on a *T*-period par-valued coupon-paying bond; i.e., $M(T;\delta)\equiv y(T;\delta)-r_f$.

$$M(T;\delta)=\frac{\Pr(T)+r_f-\Pr(T)\delta}{1-\Pr(T)[1-\delta]}-r_f=\frac{\left[1+r_f\right]\Pr(T)[1-\delta]}{1-\Pr(T)[1-\delta]}. \qquad (3)$$

For a 100% recovery rate $y(T;1) = r_f$ and the debt margin is $M(T;1) = 0 \; \forall \, T$. For a 0% recovery rate the debt margin is $M(T;0) = \left[1 + r_f\right]\left[\frac{\Pr(T)}{1 - \Pr(T)}\right] \forall \, T$.

Relation (3) can be used to examine how debt margins change with maturity:

$$\frac{\partial M(T;\delta)}{\partial T} = \frac{\partial \Pr(T)}{\partial T} \frac{\left[1 + r_f\right][1 - \delta]}{\left[1 - \Pr(T)[1 - \delta]\right]^2}.$$

$\frac{\partial M(T;\delta)}{\partial T}$ has the same sign as $\frac{\partial \Pr(T)}{\partial T}$ and we obtain the fundamental result:

> *The term structure of credit spreads mirrors the term structure of the risk-neutral probability of per period bankruptcy: If the per annum probability of default increases (decreases) with maturity, so to does the debt margin.*

A non-technical variant of this result was first formulated in Johnson (1967) as the “crisis-at-maturity” hypothesis.[56] Johnson observed that firms with speculative-grade debt outstanding can face severe problems in meeting their coupon and principal repayment commitments if the debt is about to mature. In consequence, the probability of default in the short term can be very high and the margin on short-term debt can be very high. But survival for some period of time can mean that the firm has overcome its immediate problems and now faces a lower risk of default in the subsequent periods. The term structure of credit spreads on this bond will be downward-sloping.[57]

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[56] Johnson, Ramon E., 1967, “The term structure of corporate bond yields as a function of risk of default,” *Journal of Finance* 22 (2), 313-345.

[57] Using the formal model in (3) and defining $\Pr(T)$ via the geometric average of the per annum survival rates it follows that the firm that would currently be facing a crises-at-maturity if its debt were short-term has a term structure of $\Pr(T)$ that is declining with *T*. As a consequence this firm’s term structure of credit spreads is downward-sloping.

In contrast, investment grade bonds have little chance of immediate default and have correspondingly low short-term debt margins. But consider an investment grade bond with, say, 10 years to maturity. After a number of years there is a chance that firm conditions will have deteriorated and the owners of the bond may then be facing a higher likelihood of default. In fact there is some chance of a crises-at-maturity and the probability of default in year 10 need not be low. The geometric average of the series of the 10 individual one-year survival rates applicable to this bond may be lower than the survival rate over the first year of its life. In this case the credit spread on 10-year debt will exceed that on one-year debt.

In general, the term-structure of credit spreads on investment grade bonds can be either upward-sloping or humped-shaped. A hump-shape will arise when (i) there is little chance of immediate default, (ii) there is a non-trivial probability of default on □-year debt and (iii) those firms that do survive past □ years tend to have recovered from any earlier misfortune and have a reduced probability of default in the years subsequent to year □.

The logic underlying the heuristic approach in Johnson (1967) and the approximate result developed in (3) above was first formalized in Merton (1974).[58]

Part 2 A formal model of the term structure of debt margins

Merton (1974) used a variant of the Black-Scholes option pricing model to price risky zero-coupon debt. Merton's model impls that debt margins decline with maturity for below investment-grade bonds and increase or are mildly hump-shaped for investment grade bonds. Jones, Mason, and Rosenfeld (1984) extended this model to incorporate coupons and Kim, Ramaswamy and Sundaresan (1993) further extended the model to recognize bankruptcy costs. [59,60] Anderson and Sundaresan (1996) undertook a different extension that recognized the possibility of strategic behaviour by a firm that threatens to pay less than it is contractually obligated knowing that if the bondholders do not accept the reduced payment they will have to bear high costs of enforcing the terms of the debt contract.[61]

[58] Merton, R. C., 1974, "On the pricing of corporate debt: The risk structure of interest rates," *Journal of Finance* 29, 449-470.

[59] Jones, E. P., S. P. Mason, and E. Rosenfeld, 1984, "Contingent claims analysis of corporate capital structures: An empirical analysis," *Journal of Finance* 39, 611-625.

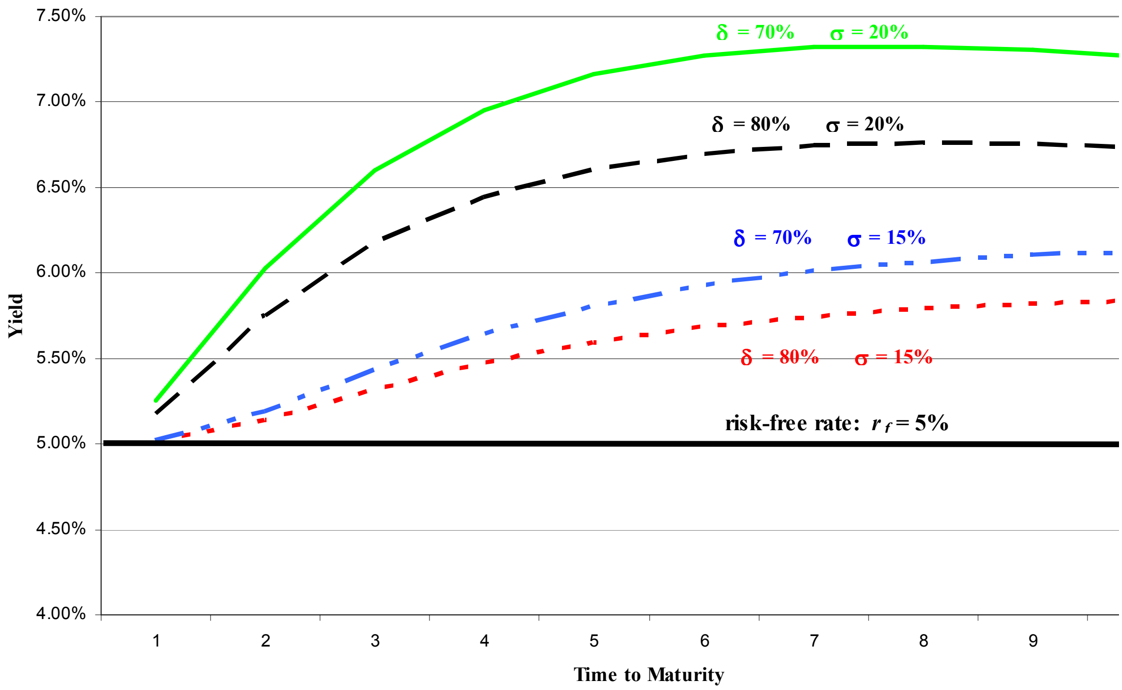
[60] Kim, I. J., K. Ramaswamy, and S. M. Sundaresan, 1993, "Valuation of corporate fixed-income securities," *Financial Management*, *Special Issue on Financial Distress*, Autumn, 117-131.

[61] Anderson, Ronald W. and Suresh Sundaresan, 1996, "Design and valuation of debt contracts," *Review of Financial Studies* 9(1), 37-68.

The theoretical evaluation of debt margins in this section does not consider strategic underpayment by firms. The evaluation does incorporate periodic coupons and bankruptcy costs. The value of the firm's underlying risky assets is assumed to follow a diffusion process with annual standard deviations of the continuously compounded percent change in firm value, □, of 15% and 20% per annum. With a 60% debt to value ratio, these values for firm volatility imply equity volatilities of 37.5% and 50% respectively. To recognize bankruptcy costs I consider recovery rates of 70% and 80% of the contractual amount due.[62] I assume a flat term structure of risk-free rates at 5% per annum.

For the four combinations of parameter values, I consider a bond maturing T years hence and solve for the yield the bond would have to promise such that the bond was worth its par value and that amount was equal to 60% of the market value of firm assets. I consider maturities of 1 through 10 years in increments of 1 year. Figure 1 depicts the yields on the risky bonds as a function of T. The debt margin is simply the excess of the yield above the 5% risk-free rate.

Figure 1: Term Structure of Yields



62 The theoretical valuation exercise of Kim, Ramaswamy and Sundaresan (1993) assumes $\delta = 0.8$.

In each case the term structure of debt margins is upward sloping or very mildly hump-shaped. (In the only hump-shaped scenario, the curve is very steep when the time to maturity is less than three years.) In the hump-shaped example, the debt margin on 10-year bonds is a mere 0.69 of a basis point less than the debt margin on 6-year bonds. The conclusion drawn from this model-based analysis of debt margins is as follows:

> ***Conclusion on the term structure of debt margins based on an implementation of the extant theoretical finance literature:*** *While a downward sloping term structure of debt margins beyond 6 years cannot be ruled out in a setting with an alternate stochastic process for changes in firm value, an extended Merton (1974) model incorporating coupon payments and bankruptcy costs implies a flat or upward sloping term structure of debt margins when the model is evaluated at realistic values for the asset volatility and recovery rate parameters.*

The conclusion on the shape of the term structure of debt margins is an outcome of the risky bond pricing model that is standard in the theoretical academic literature today. But it is possible that an alternate model could produce a different conclusion. Hence it is useful to also consider the recent empirical literature on the shape of the term structure.

Part 3 The Recent empirical literature on the term structure of debt margins

Trűck, Laub and Rachev (2004) examined trade data reported on Reuters on February 11, 2004 for a large sample of Eurobonds and domestic currency bonds issued by EU countries. [63] Debt margins are calculated relative to government securities issued in the same currency. Plots of the average debt margin on investment grade bonds and of all observed debt margins on BBB-rated bonds as functions of the time to maturity are reproduced below. The figures show that the term structure of debt margins on BBB-rated European bonds was not downward sloping on February 11, 2004.

[63] Trűck, Stefan, Matthias Laub and Svetlozar T. Rachev, 2004, "The term structure of credit spreads and credit default swaps: An empirical investigation," Universität Karlsruhe Working Paper

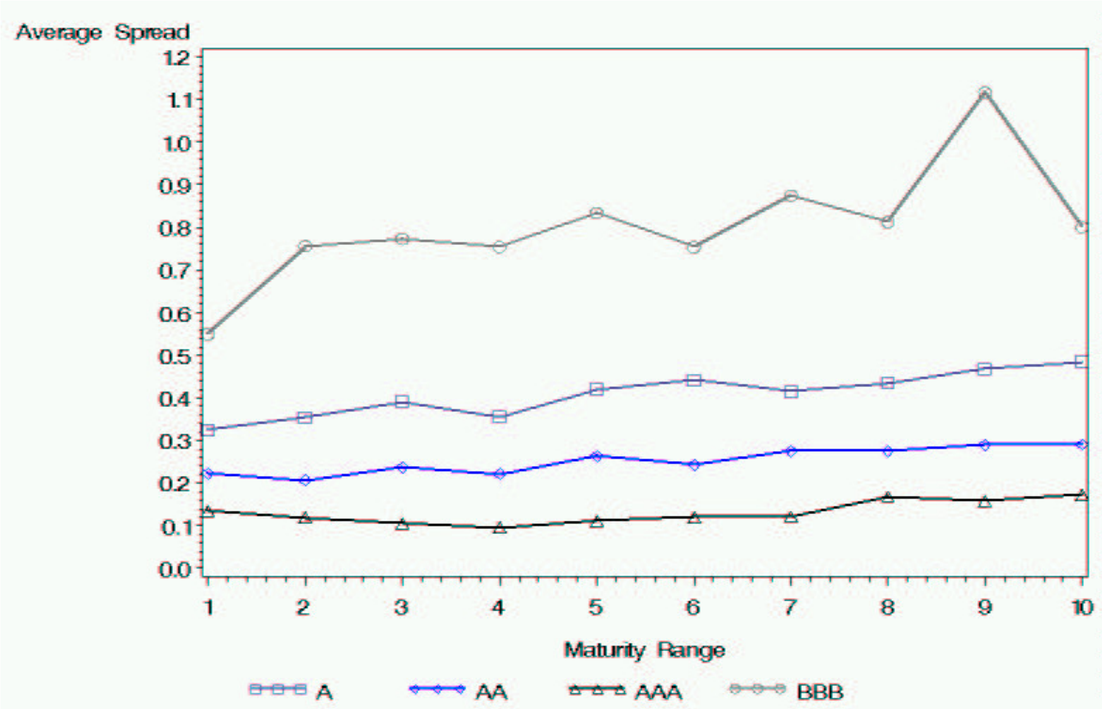


Figure 3 Average debt margins for European investment-grade bonds observed on February 11, 2004. Source: Trűck, Laub and Rachev (2004)

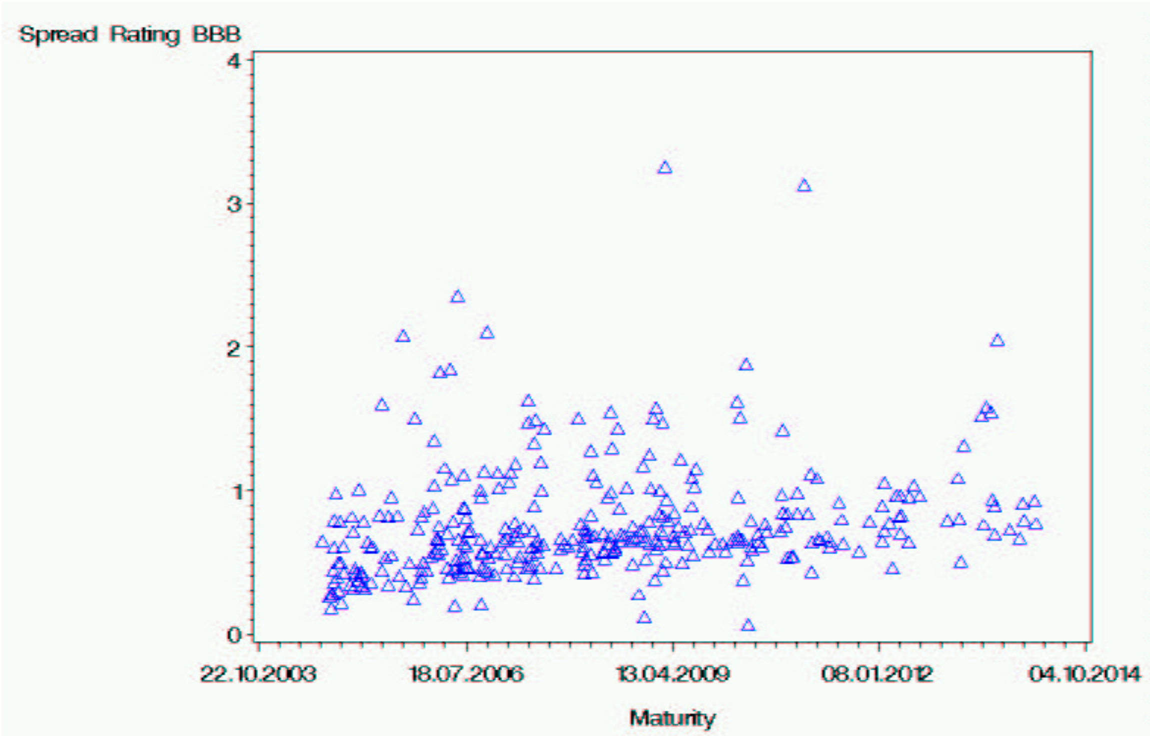


Figure 4 Debt margins for European BBB-rated bonds observed on February 11, 2004. Source: Trűck, Laub and Rachev (2004)

Bedendo, Cathcart and El-Jahel (2007) undertake the most recent study of the term structure of debt margins by investigating data from the National Association of Insurance Commissioners database of bond transactions by U.S. insurance companies between January 1995 and December 2001.64 The paper's goal is to examine the determinants of the slope and curvature of the term structure of debt margins. The measure of the slope examined by the authors is the difference between the margin on 3-year and 10-year bonds of a given bond rating.

The authors calculate separate slopes for industrial and financial bonds. There are no BBB-rated financial bonds in their sample. The average value of the slope for BBB industrial bonds was 37 basis points; i.e., on average for the set of bonds traded by insurance companies between 1995 and 2001 inclusive the debt margin on 10-year

[64] Bedendo, Mascia,Lara Cathcart and Lina El-Jahel, 2007, "The slope of the term structure of credit spreads: An empirical investigation," *The Journal of Financial Research* 30(2), 237–257.

BBB-industrials exceeded the debt margin on 3-year BBB-industrials by 37 basis points.

Conclusion on the term structure of debt margins based on the extant empirical finance literature*: The empirically observed term structure of debt margins on BBB-rated bonds is largely flat with some evidence of a mild humped shape and some evidence of an upward slope. There is no evidence of a downward sloping term structure of debt margins on BBB-rated bonds.*

Appendix A. Bloomberg data and screen shots

170. Below are relevant 'screen shots' taken from Bloomberg and also a list of all BBB and A rated bonds used in the analysis of Bloomberg 6th May 2009 fair value curves.

Figure 14: Description of Bloomberg Generic Price

<HELP> for explanation, <MENU> for similar functions. CurncyFAQD

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BLOOMBERG GENERIC PRICE

Explanation:

Bloomberg Generic Price (BGN) is Bloomberg's market consensus price for corporate and government bond. Bloomberg Generic Prices are calculated by using prices contributed to Bloomberg and any other information that we consider relevant. Bloomberg does not make a market in any of the securities that we price. The actual methodology we use is proprietary and depends on the type of pricing and the markets involved. The goal of the methodology is to produce "consensus" pricing. To the extent that we are not comfortable that a bond can be assigned a consensus price at any time, we will mark it "not priced". We constantly and vigorously review the performance of the system and alter it as we determine necessary to achieve our goal.

To change pricing sources for a bond:

Type CT30<GOVT> PCS<GO>

Related Functions:

1) CT30 Govt PCS - Price Source Selection

Related FAQs:

2) BLOOMBERG FAIR VALUE

Figure 15: Description of bonds included in Bloomberg A and BBB fair value construction

A

Page
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Hit <PAGE> for more info or <MENU> for a list of curves

Sector 359 AUD Corporate (A) Type: Aussie$ Domestic Page 3 of 4
Ticker:C359.. Curve freq: 2 Last fit to close: 5/ 6/09 07:43 ET

TICKER	CPN	MATURITY	PRICE	BFV	OPT	YIELD	OAS	PX DIFF
X 1) AANAU	6.750	9/15/2009		100.66				
2) TCLAU	6.000	12/07/2009	100.66	100.71	0.00	4.81	7.47	0.04
X 3) CITI	5.750	2/28/2010		100.75				
4) TELECO	7.250	3/30/2010	102.17	102.11	0.00	4.71	-6.77	-0.06
X 5) WDCAU	5.500	7/15/2010		100.56				
X 6) CBA	6.000	7/20/2010		101.12				
X 7) HBOS	5.750	10/26/2010		100.61				
X 8) CFXAU	6.500	11/12/2010		101.63				
9) WOWAU	6.000	3/14/2011	100.50	100.44	0.00	5.70	-3.63	-0.06
10) RBS	8.500	6/10/2011	105.06	104.94	0.00	5.88	-6.10	-0.12
X11) SGPAU	6.250	6/16/2011		100.55				
X12) CPFAU	6.600	6/28/2011		101.22				
13) TCLAU	6.500	9/15/2011	100.51	100.88	0.00	6.26	17.33	0.37
X14) HBOS	6.250	10/19/2011		100.25				
15) SPOWER	6.500	11/03/2011	100.86	100.78	0.00	6.12	-3.49	-0.08
16) SPOWER	6.250	11/30/2011	100.10	100.13	0.00	6.21	1.18	0.03
X17) CFXAU	5.750	9/02/2012		97.81				
18) TELECO	7.250	11/15/2012	102.59	102.24	0.00	6.41	-11.27	-0.35
X19) SGPAU	6.000	5/15/2013		97.73				
20) TELECO	6.250	11/15/2013	97.30	97.27	0.00	6.96	-0.69	-0.03

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BBB

Page   Corp **CURV**

Hit <PAGE> for more info or <MENU> for a list of curves

Sector 356   AUD Corporate (BBB)   Type: Aussie$ Domestic   Page 3 of 3

Ticker:C356..   Curve freq: 2   Last fit to close: 5/ 6/09 07:41 ET

TICKER	CPN	MATURITY	PRICE	BFV	OPT	YIELD	OAS	PX DIFF
X 1) ENPGAS	6.500	7/29/2009		100.33				
X 2) DXSAU	6.750	2/04/2010		100.84				
3) SNOWY	5.750	2/25/2010	99.86	100.10	0.00	5.92	32.17	0.25
4) FBG	6.250	3/17/2010	100.73	100.48	0.00	5.35	-30.84	-0.26
X 5) BACAU	7.300	6/30/2010		101.54				
X 6) MGRAU	6.750	9/15/2010		100.95				
X 7) GPTAU	6.250	11/07/2010		100.23				
8) BQDAU	6.000	12/02/2010	99.92	99.81	0.00	6.05	-7.62	-0.11
9) DXSAU	6.750	2/08/2011	100.71	100.82	0.00	6.31	7.27	0.12
X10) CWNAU	6.280	5/06/2011		99.87				
X11) FXJAU	6.865	6/27/2011		100.74				
12) ORGAU	6.500	10/06/2011	100.05	99.60	0.00	6.47	-20.52	-0.45
13) TABAU	6.500	10/13/2011	99.69	99.57	0.00	6.64	-5.24	-0.12
X14) SYDAAU	6.250	11/21/2011		98.78				
15) WESAU	6.000	7/25/2012	95.93	96.56	0.00	7.44	22.92	0.63
X16) SNOWY	6.500	2/25/2013		96.69				
17) SANTOS	6.250	9/23/2015	91.54	91.62	0.00	7.97	1.87	0.09

Note that a 'cross' next to a bond indicates that it was not used by Bloomberg to estimate its fair value curve.

Table 7: All A and BBB rated bonds with Bloomberg pricing on the 6th May 2005

Bond	Maturity	Term to Maturity	Yield	CGS FV
BBB				
ENPGAS 6.5Corp	29/07/2009	0.23	5.82	2.64
DXSAU 6.75Corp	4/02/2010	0.75	6.33	2.68
SNOWY 5.75 Corp	25/02/2010	0.81	5.92	2.68
FBG 6.25 Corp	17/03/2010	0.86	5.35	2.69
BACAU 7.3 Corp	30/06/2010	1.15	6.50	2.80
MGRAU 6.75 Corp	15/09/2010	1.36	6.69	2.93
GPTAU 6.25 Corp	7/11/2010	1.51	18.58	3.02
BQDAU 6 Corp	12/02/2010	0.77	6.05	2.68
DXSAU 6.75 Corp	8/02/2011	1.76	6.31	3.18
CWNAU 6.28 Corp	6/05/2011	2.00	7.58	3.33
FXJAU 6.865 Corp	27/06/2011	2.14	21.28	3.38
ORGAU 6.5 Corp	6/10/2011	2.42	6.47	3.49
TABAU 6.5 Corp	13/10/2011	2.44	6.64	3.50
SYDAAU 6.25 Corp	21/11/2011	2.54	7.49	3.54
WESAU 6 Corp	25/07/2012	3.22	7.45	3.78
SNOWY 6.5 Corp	25/02/2013	3.81	7.46	3.96
SANTOS 6.25 Corp	23/09/2015	6.38	7.97	4.50
A				
AANAU 6.75 Corp	15/09/2009	0.36	4.98	2.65
TCLAU 6 Corp	7/12/2009	0.59	4.81	2.66
CITI 5.75 Corp	28/02/2010	0.82	5.82	2.69
TELECO 7.25 Corp	30/03/2010	0.90	4.71	2.69
WDCAU 5.5 Corp	15/07/2010	1.19	8.34	2.83
CBA 6 Corp	20/07/2010	1.20	6.00	2.83
HBOS 5.75 Corp	26/10/2010	1.47	6.66	3.00
CFXAU 6.5 Corp	12/11/2010	1.52	7.33	3.03
WOWAU 6 Corp	14/03/2011	1.85	5.70	3.24
RBS 8.5 Corp	10/06/2011	2.09	5.88	3.37
SGPAU 6.25 Corp	16/06/2011	2.11	9.62	3.37
CPFAU 6.6 Corp	28/06/2011	2.14	6.71	3.38
TCLAU 6.5 Corp	15/09/2011	2.36	6.26	3.47
HBOS 6.25 Corp	19/10/2011	2.45	7.79	3.50
SPOWER 6.5 Corp	3/11/2011	2.49	6.12	3.52
SPOWER 6.25 Corp	30/11/2011	2.57	6.21	3.55
CFXAU 5.75 Corp	2/09/2012	3.33	9.00	3.81
TELECO 7.25 Corp	15/11/2012	3.53	6.41	3.88
SGPAU 6 Corp	15/05/2013	4.02	11.71	4.03
TELECO 6.25 Corp	15/11/2013	4.53	6.96	4.19
CIVIC 6.5 Corp	15/09/2014	5.36	7.27	4.38
TELECO 6.25 Corp	15/04/2015	5.94	7.41	4.45

Escalation factors affecting expenditure forecasts

A report for Country Energy

Dr. Tom Hird
Daniel Young

June 2009

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Executive Summary

1. CEG has been commissioned by Country Energy to estimate cost escalation factors in order to project forward the costs of its operating and capital expenditure for the 2010-11 to 2014-15 regulatory period. Country Energy has requested that cost escalation factors be developed for:

   - aluminium;
   - steel;
   - polyethylene; and
   - concrete.

2. The terms of reference for this engagement stipulate that these cost escalation factors should be consistent with the National Gas Rules, and in particular Rule 74(2), which states that any forecast or estimate:

   (a) must be arrived at on a reasonable basis; and

   (b) must represent the best forecast or estimate possible in the circumstances.

3. We consider that the estimates presented in this report and the methodologies that we use to derive them are consistent with these requirements.

4. In order to estimate a set of escalation factors to extend forward Country Energy's costs, it is necessary to form a view about the future movements of wages and commodity prices. The methodology that we have adopted in this report is to source predictions of future prices for these inputs, whether in the form of futures prices or expert forecasts, and to rely on these data to develop escalation factors. Where futures prices are available and are sufficiently liquid, we have used these in preference to forecasts on the basis that these represent the best forecast of prices by informed market participants.

5. Issues of consistency in timing are crucial to the development of escalation factors, because their function is to project forward prices or costs from one period to another. Due to the way that spending forecasts are used in regulatory modelling, the escalation factors required to project forward operating and capital expenditure must be made on a different basis. Operating expenditure must be projected forward to the mid-point of each financial year, using the forecast change in average costs between financial years, or 'financial year' escalators. On the other hand capital expenditure must be projected forward to the end of each financial year, using the change in average costs over each calendar year, or 'calendar year' escalators. Our understanding is that all of Country Energy's operating and capital costs are based on prices prevailing over the 2008-09 financial year.

6. In general, the methodology applied in this report to estimate escalation factors is characterised by a high degree of transparency over the use of input data to estimate escalation factors and is consistent with the methodology applied by the Australian Energy Regulator (AER) in its calculation of escalation factors for its Final Determinations for the New South Wales and Tasmanian electricity businesses.

7. CEG's estimates of Country Energy's escalation factors are set out in Table 1 below.

Table 1: Escalation factors for Country Energy, real

Financial year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Aluminium	-8.2%	9.4%	8.3%	7.6%	6.6%	5.9%
Steel	-18.3%	7.9%	5.6%	1.4%	0.9%	0.8%
Polyethylene	0.6%	1.9%	1.0%	0.3%	0.2%	0.2%
Concrete	2.8%	1.0%	2.9%	2.8%	1.8%	0.9%
Crude oil	1.8%	10.7%	5.0%	1.6%	1.4%	0.7%
Construction	-2.1%	-0.3%	-0.4%	0.3%	-1.1%	-2.1%
Calendar year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Aluminium	-14.2%	12.1%	8.6%	8.1%	7.0%	6.2%
Steel	-21.6%	9.5%	5.9%	3.4%	1.0%	0.9%
Polyethylene	-2.6%	4.5%	1.4%	0.6%	0.2%	0.2%
Concrete	2.5%	0.4%	2.2%	3.1%	2.3%	1.3%
Crude oil	-11.8%	22.4%	7.5%	2.9%	1.2%	1.5%
Construction	-0.9%	-1.5%	-0.3%	0.0%	-0.2%	-1.7%

1. Introduction

8. Country Energy has engaged CEG to provide advice on the development of annual escalation factors for its operating and capital expenditure programs.

9. Escalation factors, properly derived, can be used to project forward the value of base objects into the future. An example of a base object may be the average wages of a full time employee in the electricity, gas and water sectors over the 2007/08 financial year. Planning of future projects may be conducted on the basis that a certain number of such employees may be required over a period of time during the next regulatory period. Escalation factors for EGW wages can be used to determine the expected cost of the labour input to this project.

10. The methodology for determining escalation factors has become significantly refined over the course of the South Australia, New South Wales and Tasmanian electricity network determinations. Although there are still areas where the businesses are in dispute with the AER, at a high level there is general agreement as to the best approach to calculate escalation factors for:

- aluminium;
- steel; and
- crude oil.

11. In this report, we review the foundations for the methodology that has been applied in the context of the electricity determinations and re-estimate escalation factors based on the most recently available data. Furthermore, we propose methodologies for calculating escalation factors for additional inputs relevant to the gas context, including:

- concrete; and
- polyethylene.

2. Description of methodology

12. In order to escalate forward Country Energy's operating and capital expenditure it is necessary to obtain or develop forecasts of either:

    a. the price of goods and services directly purchased by Country Energy; or

    b. the price of inputs used in the production of goods and services directly purchased by Country Energy for the purpose of delivering its expenditure programs.

13. This task would best be achieved by examining forecasts of prices for all inputs purchased by Country Energy (ie, category a) above). Unfortunately, with the exception of labour costs, such forecasts generally do not exist. For example, while there are forecasts for labour costs in the New South Wales electricity, gas and water sector, there are few if any forecasts of the cost of equipment purchased by Country Energy (such as pipes, meters and regulators, etc).

14. The lack of such forecasts for most goods and services purchased by Country Energy reflects the specialised and heterogeneous nature of these goods and services – such that there is insufficient demand for forecasts of these prices and no active trading in 'futures' for these goods and services. For example, there is no formal 'futures market' for plastic pipes.

15. However, for many of these inputs used in the production of equipment/services purchased by Country Energy there are raw material forecasts and/or futures prices that can inform forecasts for the prices of the inputs themselves. Specifically:

    c. futures prices and forecasts for aluminium and crude oil can be used to inform forecasts for the value of these materials as components of Country Energy's expenditures;

    d. forecasts of the price of steel, concrete and labour can be used to project forward the value of these components of Country Energy's expenditures; and

    e. forecasts of general cost movements (eg, consumer price index or producer price index) can be used to derive changes in the cost of other inputs used by Country Energy or its suppliers that not captured above (eg, energy costs and equipment leases etc).

16. This high-level approach has previously been proposed by CEG in its reports for electricity businesses[1] and has been accepted by the AER in its Final Determinations for ElectraNet, Transend and the New South Wales electricity network businesses.

17. The necessary steps required to develop a forecast for the escalation of an expenditure program are as follows.

- Step 1- break down the expenditure program into different cost categories for which there are cost forecasts (or for which cost forecasts can be derived);
- Step 2 – source/derive the relevant cost forecasts;
- Step 3 – calculate a weighted average escalation factor using weights derived in Step 1 and forecasts from Step 2.

18. In order to complete Step 2 where there are no futures or forecasts available for a particular good or service (eg, gas regulators) it may be necessary to derive a forecast for that good or service from other forecasts. The methodology taken in deriving a forecast for, say, gas meters is similar to the above – the only difference being the starting point is not a breakdown of the costs of the overall capex program but a breakdown of the costs of gas meters. It can be described as follows:

- Step 2A – breakdown the cost of production for that good/service into component inputs parts for which there are forecasts available (eg steel, aluminium and labour);
- Step 2B – source the relevant input cost forecasts;
- Step 2C – calculate a weighted average escalation factor using weights derived in Step 2A and forecasts from Step 2B.

19. The remainder of this section sets out a number of considerations that guide the approach set out above.

2.1. Preference of futures over forecasts

20. Consistent with the approach approved by the AER in its recent New South Wales and Tasmanian electricity Final Determinations, in coming to our estimates of Country Energy's future escalation factors we have had regard to various predictions of how prices may change in the future. These predictions have been obtained from two general sources: futures market prices and expert forecasts.

[1] See: CEG, *Escalation factors affecting capital expenditure forecasts: a report for ElectraNet*, January 2008; CEG, *Escalation factors affecting expenditure forecasts: a report for NSW electricity businesses*, April 2008; and CEG, *Escalation factors affecting expenditure forecasts: a report for NSW and Tasmanian electricity businesses*, January 2009.

21. In CEG's opinion the most reliable forecast for input prices is provided by prices determined in the futures market – provided that the relevant market is sufficiently liquid. That is, the most reliable predictor of prices on a particular date in the future is the price at which market participants are willing to commit to trading on that day. If there were a better estimate of future prices then investors could expect to profit by buying/selling futures until today's futures price reflected the best estimate of spot prices on the relevant future date.

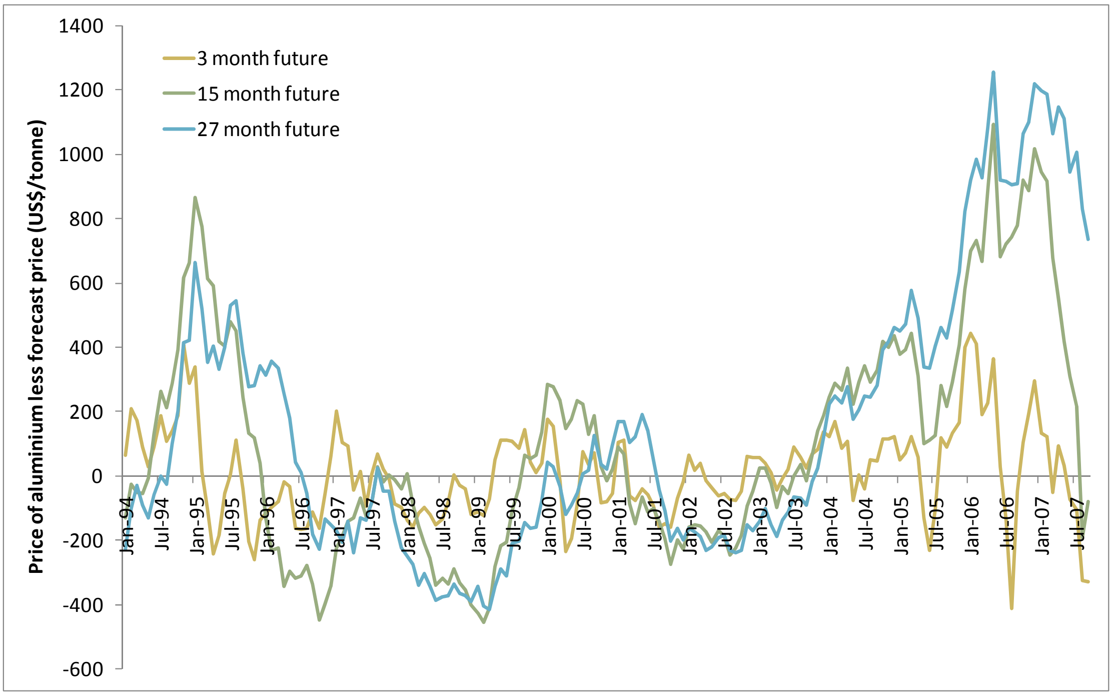
22. Of course, futures prices will be very unlikely to exactly predict future spot prices given that all manner of unexpected events can occur. In fact, futures prices have spectacularly underestimated refined aluminium prices in the last few years (see below graph). However, they nonetheless provide the best estimate of future spot prices. An important reason why futures markets are more reliable than professional forecasters is that in order to participate in a futures market (and help set the price in that market) you must be willing to risk real money.

23. This is a standard proposition in finance theory not just limited to futures markets for base metals and oil. The International Monetary Fund also makes the same point when it states:

> *"While futures prices are not accurate predictors of future spot prices, they nevertheless reflect current beliefs of market participants about forthcoming price developments. Bowman and Husain (2004) find that futures-prices-based models produce more accurate forecasts than the models based on historical data or judgment, especially at long horizons."*[2]

[2] IMF, *World Economic Outlook*, April 2007, p.8

Figure 1: Actual prices less prices predicted by LME futures (nominal, US$/tonne)



24. The graph above shows that, over most of the 1990's, futures prices were a reasonable predictor of aluminium spot prices. However, during the first half of the current decade futures prices have systematically underestimated spot prices (ie, failed to anticipate the increase in spot prices and overestimated the rate at which they would subsequently fall).

2.2. Real versus nominal escalation

25. It is our understanding that the escalation factors that are to be applied to both operating and capital expenditure must escalate the real price of the underlying good or service, not the nominal price. This is because the future costs of Country Energy are expressed in real terms in the AER's regulatory modelling and are re-inflated in the context of that model. However, it is not always possible to obtain forecasts of future price movements that are expressed in real terms.

26. For wage, construction and concrete costs we have relied on professional forecasters' opinions of the future level of price escalation. Where the forecaster is also an acknowledged macro-economic forecaster we have used its forecasts of inflation to derive an associated real forecast from its nominal forecast. Where the forecaster is a sectoral specific forecaster (rather than a macro-economic forecaster) we have used

our own estimate of expected inflation derived on the basis of the Reserve Bank of Australia's (RBA) forecasts. The derivation of this forecast is very simple, aligns with the method utilised in the AER's spreadsheet modelling for the New South Wales and Tasmanian Final Determinations, and is explained in Box 1 below.

27. For example, in the following section we utilise constuction cost forecasts from Econtech. Econtech has acknowledged expertise in macro-economic forecasts and we have derived real construction cost forecasts by deflating their nominal wage forecasts by the forecasts of inflation that it has made on a consistent basis.

28. By contrast, where we have relied on futures markets to derive forecasts of particular prices (eg, for aluminium) we have deflated these by a inflation forecast based on RBA data. This is because futures contracts tend to be written in nominal terms and it is not possible to 'see' the inflation expectations of the parties to that contract.

Box 1: Derivation of forecast CPI index based on RBA forecasts

The RBA issues a Statement on Monetary Policy four times a year. Since February 2007, the RBA has released as part of these statements its forecast of CPI changes over the next two to three years. An example of February 2009 forecast is shown below.

Table 14: Output and Inflation Forecasts[(a)]

Percentage change over year to quarter shown

	Sep 2008	Dec 2008	June 2009	Dec 2009	June 2010	Dec 2010	June 2011
GDP	1.9	1	¼	½	1¼	2½	3¼
Non-farm GDP	1.7	1	0	¼	1¼	2½	3¼
CPI	5.0	3.7	1¾	2½	2¾	2½	2
Underlying inflation	4.7	4.3	3½	3	2¾	2½	2

(a) Actual GDP data to September 2008 and actual inflation data to December 2008. Underlying inflation refers to the average of trimmed mean and weighted median inflation. For the forecast period, technical assumptions include A$ at US$0.65, TWI at 54, cash rate at 3.25 per cent, and WTI crude oil price at US$55 per barrel and Tapis crude oil price at US$57 per barrel.

Sources: ABS; RBA

In combination with the historical Australian Bureau of Statistics (ABS) series for CPI, the RBA forecasts naturally lend themselves to the creation of a forecast index, based on the following steps:

- obtain historical CPI from the ABS, currently available up to and including the March quarter 2009;
- estimate the June and December 2009 forecast index numbers based on the

actual index numbers for June and December 2008 and the change in CPI forecast by the RBA;

- estimate subsequent June and December forecast index numbers based on the forecast index numbers for the previous June and Decembers and the change in CPI forecast by the RBA;
- beyond the horizon of the RBA forecasts, estimate June and December forecast index numbers based on the forecast index numbers for the previous June and December, increased by 2.50%; and
- calculate all forecast March and September quarter indices by interpolating between the relevant June and December quarters.

The use of 2.50% as a long-term forecast of inflation is selected as being the mid-point of the RBA's target range of 2-3%. We note that the entirety of this methodology is consistent with the approach utilised in the AER's spreadsheet modelling for the New South Wales and Tasmanian Final Determinations.

2.3. Forecasting foreign exchange movements

29. An important determinant of future equipment prices is the future value of the Australian dollar. This is clearly true of imported equipment but is also true in relation to the purchase of domestically produced equipment that may nonetheless be sold on a world market and in relation to the input costs for domestic suppliers (eg, the cost of aluminium and steel for Australian producers of gas meters and regulators).

30. In the context of Country Energy's escalation factors, it is normally the case that commodities traded on international markets are priced in terms of United States dollars, and generally futures and forecasts of these commodities are also based in these terms. This means that we must establish a forecast of the value of the Australian dollar, in terms of the United States dollar, over the relevant horizon so that forecasts of commodity prices can be expressed in Australian dollar terms.

31. The fact that there is a recognised link between commodity prices and the value of the Australian dollar is particularly important to this project as it means that cost reductions associated with falling commodity prices can be expected to be at least partially offset by concurrent depreciation in the Australian dollar. This link between the Australian dollar and commodity prices is accepted by both the RBA and in academia. The RBA has recently sought to explain record high Australian dollar values in relation to high levels of commodity prices.

"The continued strength in commodity prices, together with higher interest rates in Australia than abroad, helped underpin the Australian dollar's rise to multi-year highs against the US dollar and on a trade-weighted basis in July, before the currency depreciated somewhat following the disturbances in credit markets. It has also contributed to the larger increase in the Australian stock market than in other major markets, as the share prices of resource companies have been particularly strong."[3]

32. Similarly, the link between the Australian dollar and commodity prices has been confirmed in academic studies such as that by Hatzingkolaou and Polasek (2005) who state that their empirical results:

"…strongly supports the widely held view that the floating Australian dollar is a 'commodity currency'."[4]

33. On this basis it is important to use a forecast for the Australian dollar that is consistent with the forecast for commodity prices used. Certainly, it would be inconsistent to adopt an assumption of dramatic falls in commodity prices without also forecasting a similarly dramatic reduction in the value of the Australian dollar.

34. However, it is notoriously difficult to forecast even short term movements in exchange rates, let alone long-term movements. Futures markets for the Australian dollar are relatively thin beyond a few months and these short dated futures are, in any event, driven by differences in risk-free interest rates across countries.[5] It is not possible to use futures markets to forecast out the value of the Australian dollar in 2015.

35. Although a number of organisations provide forecasts of the Australian dollar over a short horizon, the only long term forecasts of the Australian dollar we are aware of are provided by Econtech in its ANSIO reports. For the purpose of this report we adopt the Econtech forecasts to convert United States dollar forecasts for commodity prices to the Australian dollar price of those commodities.

2.4. Timing of escalation factors

36. Issues of timing are critical to determining escalators that can consistently be applied for this purpose. An escalator provides an estimate for the increase in price for an input from one period to another. For consistency it is important that the escalation factors that are applied to the base planning objects must:

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3 RBA, *Statement on Monetary Policy*, August 2007, p.2

4 Hatzinkolaou, D., and Polasek, *Journal of Applied Economics*, Vol VIII, No. 1, May 2005, pp.81-99.

5 That is, futures reflect the difference in those interest rates such that it is possible for bond holders to 'lock in' the same risk free rate in their home currency by holding foreign bonds. This phenomenon is known as covered interest parity.

i. be derived in a way that is consistent with the base period in which these costs have been measured;

ii. be derived in a way that is consistent with their intended use in forecasting future costs in specific periods; and

iii. avoid overlapping periods or 'gaps' such that escalation is either not properly accounted for or is double counted.

37. It is our understanding that escalation factors are used for two purposes:

- to inflate the base planning objects for capex to the end of each financial year in the next regulatory period; and
- to inflate the base planning objects for opex to the mid-point of each financial year in the next regulatory period.

38. Furthermore, it is our understanding that Country Energy's base planning objects for capital and operating expenditure have been costed as an average over the 2008-09 financial year. Given these considerations, the escalators that take these objects forward must be based in the periods consistent with the costing of the objects that they take forward, as is required by i above.

39. Consistent with the base period for costing and the purpose for escalation, escalation factors that take forward operating expenditure must escalate from average costs over a financial year to average costs over the next financial year – in the sense that inflating opex to the mid-point of a financial year is intended to be representative of the entire financial year. We refer to this type of escalator as a 'financial year' escalation factor.

40. For similar reasons, capex must be taken forward using escalation factors that measure the differences in average costs between calendar years. This is because regulatory modelling typically treats capex as an amount that is added to an asset base at the end of the financial year, and so financial year escalators cannot be used to project these forward. We refer to escalators that project forward objects from average costs over a calendar year into the next calendar year as 'calendar year' escalators.

41. We understand that this methodology and the terminology associated with it has already been accepted by the AER in the context of its Final Determinations for the New South Wales and Tasmanian electricity businesses.

42. Finally, it is important that escalation factors do not either omit or double-count price changes over a particular period of time. Whilst all these criteria may seem trivial, it is our experience that achieving timing consistency is one of the most difficult and contentious issues in the development of escalation factors.

2.5. Quarterly indexation using annual escalators

43. Many of the forecasts that we have regard to in deriving escalation factors, such as those provided by Econtech and Macromonitor, express forecast changes as *change in average prices from one financial year to the next*. These lend themselves naturally to use as financial year escalation factors, as described above.

44. However, sometimes forecasts expressed in this way cannot be so readily used. For example, the methodology used by the AER in its Final Determinations for the New South Wales and Tasmanian electricity businesses assumed that Econtech forecasts for EGW wages would only be applied after the expiry of each firm's enterprise bargaining agreement (EBA). In some cases, this transition was made at the start of the calendar year, which meant that the Econtech forecasts could not straightforwardly be applied to the data in order to project it forward.

45. In the context of these Final Determinations, the AER accepted the views of its consultant, Econtech, that its forecasts could be used to construct a quarterly index that could then be used to estimate forecasts or escalators based on alternative timing assumptions. Econtech proposed a four-part equation,[6] an example of which is:

- Index for September 09 = (2 * Index(07-08) + 7 * Index(08-09) – Index (09-10))/8
- Index for December 09 = (9 * Index(08-09) – Index (09-10))/8
- Index for March 09 = – (Index(07-08) + 9 * Index(08-09))/9
- Index for February 09 = – (Index(07-08) + 7 * Index(08-09) +2 * Index (09-10))/8

46. The main rationale behind the choice of these formulae was that the quarterly index derived by their use was consistent with the annual forecasts from which they were estimated. We note that that this set of formulae is not the only method by which such an index could be constructed, but we regard it as reasonable for its purpose.

47. The AER used these formulae in its Final Determinations in respect of Econtech forecasts for EGW wages, general labour and construction. However, the formulae are not specific to use with Econtech forecasts, and in this report we apply them generally to any forecast expressed in this way. We also employ these formulae, translated by two quarters, to convert forecasts expressed in average calendar year terms into a quarterly index. For example, United States inflation forecasts from the Congressional Budget Office are expressed in these terms.

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6 Econtech, *Updated labour cost growth forecasts*, 25 March 2009, pp.23-4

2.6. Precision and accuracy

48. There is always a high degree of uncertainty associated with predicting the future. Although we consider that we have obtained the best possible estimates of Country Energy's future costs at the present time, the actual magnitude of these costs at the time that they are incurred may well be considerably higher or lower than we have estimated in this report. This is a reflection of the fact that while futures prices and forecasts today may well be a very precise estimate of current expectations of the future, they are at best an imprecise estimate of future values.[7]

49. This lack of precision of forecasts is recognised in our methodology in at least two ways. Firstly, when we estimate future costs at times between estimates obtained from futures prices or forecasts, these are always calculated using linear interpolation, rather than fitting a more complicated functional form. Secondly, all escalation factors recommended are reported to one decimal place only.

50. Although the spreadsheet modelling underling the calculation of these escalation factors may, in some cases, predict quarterly or even monthly values of commodity prices in the future, we do not represent that it is possible to generate precise estimates for these values. Rather, this modelling approach is used because futures prices and forecasts often themselves make predictions for a particular quarter in the future, so we must adopt a similar structure to incorporate these predictions.

51. Finally, we note the distinction between precision and accuracy. Although there is considerable imprecision in predicting the future, this is not a reason to estimate escalation factors that are artificially biased upward or downward, even if this bias is relatively small.

[7] See, for example, Figure 1 above.

3. Forecasts of component cost inputs

52. The following section sets out the specific considerations that have been made regarding the derivation of escalators for Country Energy's expenditure programs. These considerations guide the data sources and methodology that have been selected in each case.

3.1. Aluminium

53. It is important to be clear when we talk about movements in 'the' price of aluminium that we are really talking about movements in the price of aluminium at a particular stage in its production process – namely refined metal to a particular specification. The prices quoted in this section are prices for aluminium traded on the London Metals Exchange that meet the specifications of that exchange. Specifically, prices are per tonne for 25 tonnes of aluminium with a minimum purity of 99.7%.[8]

54. The prices quoted are not necessarily the prices paid for aluminium by equipment manufacturers. For example, producers of meters purchase fabricated aluminium to be used in their manufacturing processes. This fabricated aluminium has gone through further stages of production than the refined aluminium that is traded on the LME. Its price can be expected to be influenced by refined aluminium prices but these prices cannot be expected to move together in a 'one-for-one' relationship.

55. The absence of a one-for-one relationship between the prices of refined aluminium traded on the LME and the price paid by manufacturers for fabricated metals as inputs to their production process does not mean that the use of LME prices to estimate escalation factors is invalid. The correct application of Step 2A, the assignation of component weights to the escalation factors derived from the forecast LME prices, can ensure that these escalation factors are used in a way that is consistent with the underlying objects that they represent.

56. We have obtained LME prices for aluminium averaged over the month of April 2009. The LME's longest dated future for these products is 27 months, allowing us to forecast prices out to and including July 2011 by interpolating between futures prices. However, available futures prices do not extend out to the end of Country Energy's regulatory period (ie, to the year ended June 2015). In this case we have two choices. We can assume that aluminium prices will remain constant in real terms from July 2011 onwards or we can have regard to professional forecasts.

8 See the London Metals Exchange website for more details of contract specifications.

57. Consensus Economics surveys professional forecasters on a range of economic variables. They regularly perform surveys of forecasters' opinions on future commodity prices, the most recent of which was conducted in April 2009.[9] In relation to aluminium prices there is a wide variety of forecasts. These forecasters provide quarterly forecasts out to September 2011 in nominal United States dollar terms.

58. Consensus Economics also provides a 'long-term' forecast in real United States dollar terms. Unlike with the shorter term forecasts, Consensus does not disclose how many or which institutions contributed to the forecasts nor does it give any information on the range of forecasts. Moreover, it is unclear what the definition of 'long term' is – Consensus Economics only states *"long term 5-10 year forecasts in real (inflation adjusted) 2008 dollar terms"*.[10] For these reasons we must treat these forecasts with some caution.

59. Consistent with the methodology employed previously by the AER, we have assumed that these long-term forecasts apply to a horizon of 7.5 years from the month in which they were made. That is, for forecasts made in April 2009, we assume that the long-term forecasts are for the month of October 2016.

60. Forecasts of the price of aluminium between the end of the LME forecasts in July 2011 and the Consensus Economics forecast in October 2016 can be generated by interpolating between these price points. However, as described above, the escalation factors beyond 2011 must be treated with caution due to their reliance on the Consensus Economics mean forecast.

61. We use the approach described above to produce a monthly series of aluminium prices, which may then be averaged to estimate financial year escalators out to 2015. These escalators are shown in Table 2 below.

Table 2: Escalation factors for aluminium, real

Financial year	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**
Aluminium	-8.2%	9.4%	8.3%	7.6%	6.6%	5.9%
Calendar year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Aluminium	-14.2%	12.1%	8.6%	8.1%	7.0%	6.2%

9 Consensus Economics, *Energy & Metals Consensus Forecasts: Minerals Monitor*, 27 April 2009.

10 Ibid, p.5

3.2. Steel

62. A component of Country Energy's costs is associated with the purchase of products using steel. For example, valves and some facility component incorporate significant amounts of steel.

63. Again, it is important to draw a distinction between the steel products used by Country Energy and the steel 'at the mill gate'. Just as is the case with aluminium, the steel used by Country Energy has been fabricated and, as such, embodies labour, capital and other inputs (eg, energy).

64. While there is not necessarily a one-for-one relationship, it is still relevant to consider what is expected to happen to 'mill gate' steel prices. The LME has recently developed a futures market for steel billet, with futures trading to a horizon of 15 months. This market is increasing in volume and is gaining some acceptance within the industry as a measure of price. However, we do not consider that these prices are as representative of the overall market for steel as LME prices for aluminium. That is, we consider that this market may not be sufficiently liquid to use LME steel prices in preference to expert forecasts.

65. Consensus Economics also provides forecasts for hot-rolled coil (HRC) for Europe and the United States – Consensus does not publish forecasts for Asian steel prices. These forecasts are in an identical format to those for aluminium, with quarterly short term nominal forecasts and a long term real forecast. It is important to note that HRC is a more processed form of steel than billet, and commands a premium over the prices reported on the LME.

66. We understand that it is likely to be the case that suppliers of equipment to Country Energy may not necessarily purchase HRC as an input to their manufacturing processes, and that steel pipe is more commonly used as a benchmark in this industry. However, there is significantly better price information available for HRC, in the form of the Consensus forecasts, than there is for steel pipe. We regard the use of HRC price forecasts to estimate escalation factors as a reasonable alternative to prices for steel pipe on the basis that, over time, the costs of producing these products are likely to move together. Although there may be short-term variance caused by factors specific to the production of steel pipe, we regard it as reasonable to forecast steel prices on this basis and that this is the best available forecasting methodology in the circumstances.

67. The escalation factors derived on the basis of the short term and long term Consensus forecasts are shown in Table 3 below.

Table 3: Escalation factors for steel, real

Financial year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Steel	-18.3%	7.9%	5.6%	1.4%	0.9%	0.8%
Calendar year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Steel	-21.6%	9.5%	5.9%	3.4%	1.0%	0.9%

3.3. Crude oil

68. In order to derive estimates of historical and forecast changes in crude oil prices we have followed largely the same approach used for aluminium. Historical data on crude oil prices have been sourced from the US Department of Energy (DoE).[11] Crude oil futures (NYMEX Crude Oil Light) have been sourced from the Chicago Mercantile Exchange. We have averaged NYMEX prices over the 20 days to 24 April 2009 for use in the estimation of escalation factors.

69. NYMEX futures are available up to December 2017 and, consequently, these can be relied on to develop forecasts of future prices without the use of forecasts from Consensus Economics or other professional forecasters. We have combined forecasts calculated on the basis of linear interpolation between each average futures price with the historical data sourced from DoE. These calculations give rise to the escalators for crude oil shown in Table 4 below.

Table 4: Escalation factors for crude oil, real

Financial year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Crude oil	1.8%	10.7%	5.0%	1.6%	1.4%	0.7%
Calendar year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Crude oil	-11.8%	22.4%	7.5%	2.9%	1.2%	1.5%

3.4. Polyethylene

70. Polyethylene is an important input into Country Energy's expenditure programs and we understand most gas piping purchased by Country Energy are made using this material.

[11] http://tonto.eia.doe.gov/dnav/pet/pet_pri_spt_s1_d.htm. Consistent with the approach used by the AER, we have used monthly prices for West Texas Intermediate crude.

71. Internationally, we are unaware of significant futures trading in polyethylene. The LME has established futures prices for thermoplastics, including polyethylene, but these extend only to a horizon of two months, making them unhelpful for the purpose of calculating escalation factors. Whilst we are aware of limited futures trading of polyethylene elsewhere, no market appears to offer the degree of liquidity or long term pricing horizon to be useful.

72. Similarly, we have been unable to locate reliable forecasts of plastics prices from professional forecasters. For example, Consensus Economics does not cover polyethylene in its Minerals Monitor.

73. However, we understand that there is a pricing relationship between crude oil and plastics, to the extent that crude oil is an important component in the manufacture of thermoplastics such as polyethylene. We have obtained a long term monthly pricing history for crude oil and thermoplastic resins from the United States Bureau of Labor Statistics from July 1991 to February 2009[12] and have used this history to obtain econometric estimates of the relationship between these commodities. A discussion of the methodology used is discussed in Appendix A to this report.

74. The relationship estimated in Appendix A has been used to generate an index of future polypropylene prices on the basis of the index of crude oil prices that underlies the crude oil escalation factors discussed at section 3.3. The nature of this relationship, in broad terms, is that approximately 17% of the variation in the price of crude oil is passed over a period of three months to polypropylene. This is unlikely to be an accurate measure at any particular point in time due to other factors, such as specific market conditions, that also affect the price of polyethylene. However, it represents the best representation of the longer term data that we have obtained. In this sense, we regard it as reasonable to forecast average polyethylene prices on this basis, and that this is the best available forecast in the circumstances.

75. Table 5 below shows the escalation factors derived on the basis of this relationship.

Table 5: Escalation factors for polyethylene, real

Financial year	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**
Polyethylene	0.6%	2.0%	1.1%	0.3%	0.2%	0.2%
Calendar year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Polyethylene	-2.6%	4.5%	1.5%	0.7%	0.2%	0.2%

12 See www.bls.gov. The series we used are 0662 and 056, available from the commodity prices component of the BLS's producer price index.

3.5. Concrete

76. Concrete is used extensively in the installation and maintenance of gas pipelines, primarily through the restoration of road and pavement surfaces following work on pipelines themselves.

77. We have commissioned a forecast for the future prices of concrete from Macromonitor. This forecast has been provided as the year-ending price of concrete, up to and including 2016. Deflating these forecasts using RBA inflation and using linear interpolation between these points, we have created a real index of concrete prices up to June 2016. The escalation factors derived from this forecast are set out in Table 6 below.

Table 6: Escalation factors for concrete, real

Financial year	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**
Concrete	2.8%	1.0%	2.9%	2.8%	1.8%	0.9%
Calendar year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Concrete	2.5%	0.4%	2.2%	3.1%	2.3%	1.3%

3.6. Construction

78. CEG is aware of a set of forecasts for construction costs in Australia by Econtech, available at the Constructing Forecasting Council website.[13] Our understanding is that these forecasts were last updated in February 2009.

79. Consistent with the practice previously proposed by CEG and accepted by the AER in its Final Determinations for the New South Wales and Tasmanian electricity businesses, we consider that the most relevant forecasts for use in this context are 'total engineering' construction forecasts. That is, because construction forecasts likely contain a significant labour component, it is likely to be double counting to obtain a forecast of construction costs specific to the EGW sector, even if such a forecast were available.

80. Although the Econtech forecasts are in nominal terms, they are packaged together with a set of forecasts for a range of economic indicators, including inflation. We have use this forecast of inflation, rather than a subsequent Econtech forecast of inflation, derive a real forecast of construction costs from the Econtech data. We understand that the Econtech forecasts are expressed in terms of the average price movement

13 See http://www.cfc.acif.com.au/analysis2.asp.

between financial years, so we have converted these to a quarterly index using the formulae set out at section 2.5 above.

81. This index gives rise to the following financial year and calendar year escalation factors for construction costs.

Table 7: Escalation factors for construction, real

Financial year	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**
Construction	-2.1%	-0.3%	-0.4%	0.3%	-1.1%	-2.1%
Calendar year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Construction	-0.9%	-1.5%	-0.3%	0.0%	-0.2%	-1.7%

Appendix A. Relationship between crude oil and polyethylene pricing

82. We have obtained an extensive monthly price history of crude oil and polyethylene, as represented in Bureau of Labor Statistics commodity statistics. This dataset extends from July 1991 to February 2009, or 212 observations. These data may be downloaded from the BLS website using produce price index codes 056 (Crude petroleum – domestic production) and 0662 (thermoplastic resins and plastics materials).

83. In order to establish the extent of any historical relationship between movements in the prices of crude oil and polyethylene that can be extended into the future, we investigated a number of hypotheses and selected the regression that provided the best fit based on the BLS data.

84. All of the tests that we undertake assumed a linear relationship between changes in the price of polyethylene (the dependent variable) and changes in the price of crude oil, including lagged changes, as the dependent variable. We did not seek to adopt an alternative functional form and we did not seek to introduce other variables to control for other factors, such as economic growth.

85. Amongst the factors that were investigated were:

- whether or not an intercept term was suggested by the data; and
- whether there was any contemporaneous relationship between changes in crude oil and polyethylene prices and if not, what the lag was in the transmission of changes in the crude oil price to changes in the polyethylene price.

86. *A priori*, we did not expect an intercept to be statistically significant, and this was confirmed by the data in a number of tests.

87. We did not find any significant relationship between contemporaneous changes in the price of crude oil and polyethylene. This is consistent with expectations since, as crude oil is an input to the production of polyethylene, one would expect price changes to follow crude oil, rather than occur simultaneously.

88. Having investigated the statistical significance of including lagged changes to the price of crude oil to explain changes to the price of polyethylene, the results suggest that the best fit is obtained with three months of lagged price changes. That is, using an iterated inclusion of lagged crude oil price changes, the coefficients on the lags are

statistically significant up to (but not including) the fourth lag. The full results of the statistical tests that were conducted are included in the spreadsheet that accompanies this report.

89. The relationship between changes in the price of crude oil and polyethylene that provided the best fit is described by the equation below.

$$\Delta PE_t = \alpha_1(\Delta PE_{t-1}) + \alpha_2(\Delta PE_{t-2}) + \alpha_3(\Delta PE_{t-3}) + u_t$$

where *t* indexes a month from 1 to 208, representing October 1991 to February 2009.

90. An abbreviated summary of the results of estimating this equation are set out in Figure 2 below.

Figure 2: Results of regression between prices changes for polyethylene and crude oil

Regression Statistics	
R Square	0.156
Adjusted R Square	0.143
Standard Error	0.025
Observations	208

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Crude oil lag 1 month	0.052	0.018	2.835	0.005
Crude oil lag 2 month	0.064	0.019	3.441	0.001
Crude oil lag 3 month	0.053	0.019	2.812	0.005

91. The interpretation of these results is that movements in the price of crude oil explains approximately 16% of the variation in the price changes of polyethylene, and that this relationship is significant at lags of 1, 2 and 3 months.[14] We have used the coefficients as estimated in the figure above to estimate changes to the price of polyethylene on the basis of past and future changes to the price of crude oil.

[14] Estimating the same equation with a fourth lag returns a coefficient on the fourth lag with an associated p-value of 0.59 – a statistically insignificant result.